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SALTON SEA SCIENTIFIC DRILLING PROGRAM

Report of the Third Quarter

FY 1986

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

SALTON SEA SCIENTIFIC DRILLING PROGRAM

Seventh Quarterly Progress Report:
Report of the Third Quarter
(April through June)
FY 1986

SEPTEMBER 1986

U.S. Department of Energy
Office of Renewable Energy Technologies
Geothermal Technology Division

EXECUTIVE SUMMARY

The progress and direction of the Salton Sea Scientific Drilling Program (SSSDP) has been outlined in a series of quarterly reports. This is the seventh report in the series. This reporting period, from April 1 through June 30, 1986, began with initiation of the 6-month shut-in period. Emphasis was placed upon conducting experiments such as downhole temperature and pressure surveys, distribution of samples to researchers, reporting and disseminating data thus far analyzed, and planning future operations in the SSSDP well.

Standby operations began with downhole temperature and pressure surveys by the USGS using Kuster temperature, and electronic memory, digital temperature and pressure tools. Successful surveys were conducted until the latter part of May, when the temperature tool being run by USGS repeatedly stopped at 6,380 ft going downhole and at 6,195 ft coming up. This was the first indication that problems, thought to be a parting of the 7-inch liner, had developed within the wellbore. In order to assess the condition of the wellbore, diagnostic testing operations were required. A Dia-Log Minimum I.D. caliper tool, and a Welex casing inspection tool and collar locator provided information about conditions in the upper part of the SSSDP wellbore. The scientific community was consulted to determine their recommended course of action, based on the diagnostic data. The consultations resulted in the development of preliminary plans for wellbore repair and preparation of cost estimates.

The reporting of scientific results was begun during this period, soon after SSSDP site operations ceased. Four reports on cores and cuttings were published in April. By June, a draft field procedures manual had been prepared by Los Alamos National Laboratory (LANL). In addition, drafts of three GeothermEx reports on flow-test results and geology were finished by mid-June. Other project reports include a geophysical well-logging report, to be released in September 1986, and various general papers for presentation at the Geothermal

Resources Council Annual Meeting in late September.

Several initiatives for additional funding have come from scientists directly involved in the SSSDP and have been directed at the three participating Federal agencies and Congress. As a result of these efforts, Congress may provide up to $3.3 million of GTD program funds in FY-1987 to continue field operations at the SSSDP site. Detailed rationales for both deepening the well and for conducting long-term flow tests have been put forward. Continued study could reveal new information about deep thermal regimes and magma-driven hydrothermal systems, contact metamorphism, resource recovery from deep hydrothermal reservoirs, behavior of high-temperature, high-salinity brine, and the performance of high-temperature materials and newly-developed high-temperature instrumentation.

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INTRODUCTION

The Salton Sea Scientific Drilling Program (SSSDP), the first major enterprise of the much broader Continental Scientific Drilling Program (CSDP), is sponsored jointly by the U.S. Department of Energy, the U.S. Geological Survey and the National Science Foundation, with Bechtel National, Inc. as the prime contractor.

The drilling phase of the SSSDP officially began on October 23, 1985 and officially ceased on March 17, 1986 at a depth of 10,564 ft. In the period covered in this quarterly report, from April 1 to June 30, 1986, the main objective was to distribute, for analysis, samples and data collected during the drilling, coring and sampling phase of the SSSDP, and to analyze, report and disseminate the results. In addition, initiatives were proposed to continue the SSSDP after the 6-month shut-in period has ended. It is evident that the principal goal of the SSSDP, to study the "roots" of a known hydrothermal system has essentially been accomplished. However, the "roots" of the hydrothermal system in the Salton Sea Geothermal Field (SSGF) were not fully penetrated. Therefore, the existing well is seen as an opportunity for obtaining further scientific knowledge.

Results of the scientific experiments conducted in this unique subsurface environment have contributed and will continue to contribute to a better understanding of Earth's thermal processes. With continuation of the SSSDP, more specific studies of magma systems, the genesis of hydrothermal ore deposits, contact metamorphism, techniques of reservoir characterization, estimates of the recoverable resource, behavior of high-temperature, high-salinity brine, and performance of high-temperature materials and improved downhole instrumentation can be implemented.

PROGRAM PLAN & ACTIVITIES

Current Program

By April 1, a number of milestones established in the original plan had been achieved. These include site and well design, site preparation and procurement, well drilling, coring and flow testing. Preparations for standby operations were made, and the site was fenced-in. From April 1 to April 22, the USGS deployed Kuster temperature, and electronic-memory, digital temperature and pressure tools to collect a series of downhole temperature and pressure measurements (a total of eleven logging runs). The series of temperature and pressure surveys, scheduled to be run to a depth of about 10,000 ft, was halted on May 28 by an obstruction in the wellbore at a depth of about 6,380 ft that prevented further lowering of the tool. Attempts to retrieve the tool were repeatedly hampered by hang-ups at 6,195 ft. After working with the tool for several hours, it was recovered with the data intact. It was suspected that the 7-inch liner had parted or collapsed.

Preliminary diagnostic testing of the 7-inch liner was performed using a minimum I.D. caliper/continuous temperature probe, a casing collar locator and a casing inspection tool. Results of the diagnostic tests were that: (1) at 6,181 ft, the liner had separated at the ninth joint; (2) open-hole existed from 6,181 ft to 6,422 ft; and (3) the liner showed little or no evidence of corrosion. If access to the bottom of the well cannot be restored, the science program, including measurement of stable downhole temperatures, could be severely limited. In order to re-establish access to the bottom of the well, and determine the location and condition of the lower 3,967 ft of liner, additional funding will be required.

Prior to conducting diagnostic tests, a leak detected around the 30-inch casing needed to be sealed in order to meet the terms of the Bechtel-Kennecott agreement. On May 30, Halliburton fulfilled this Kennecott transfer of ownership requirement by successfully sealing the leak.

Drilling and Engineering Program

Well Deepening Initiative

Although the original program goal of drilling to 10,000 ft has been exceeded, a proposal based upon scientific justification, is being considered to extend the SSSDP well depth to 13,000 or 14,000 ft. Revised cost estimates for the well deepening option and associated time estimates were developed by Bechtel, prior to well damage, and are presented in Tables 1 and 2. The average cost for well deepening was estimated to be about $2 million with a range between $1.8 million and $2.25 million. The Scientific Experiments Committee, the DOE/Office of Basic Energy Sciences (OBES) Continental Scientific Drilling Review Group and the DOE San Francisco Operations Office (DOE/SAN) have expressed support for the well deepening initiative, although concerns about lost circulation zones, cementing costs and temperatures above the limits of the scientific tools were expressed.

Program Steps	Approximate Cost Estimate ($1,000s)*
1. Mobilize rig, procure and deliver materials	120 to 300
2. Drill and core to 13,000 ft (assume average daily cost of $20,000)	640 to 720
3. Drill and core to 14,000 ft (assume average daily cost of $25,000)	425 to 500
4. Logging and temperature surveys	140 140
5. Thirty-day flow test of the open-hole interval (assume average daily cost of $10,000)	300 to 350
6. Demobilize and clean up site	160 to 200
7. Final report	30 to 40
TOTAL:	$1,800 to $2,250
TOTAL MEDIAN:	$2,000

TABLE 1: Revised Cost Estimates for Deepening the SSSDP Well and Long-Term Flow Testing (excluding additional expense of removing and replacing parted 7-inch liner).

Program Steps	Estimated Duration
1. Mobilize rig, procure and deliver materials.	30 days to 45 days
2. Drill to 13,000 ft, taking spot cores at 100 ft to 200 ft intervals, if feasible; assume 80 ft/day average drill rate (optimistic) and 70 ft/day (pessimistic).	32 days to 36 days
2a. Drill to 14,000 ft; assume 60 ft/day (optimistic) and 50 ft/day (pessimistic).	18 days to 20 days
3. Logging and temperature surveys, when and if feasible.	10 days 10 days
4. Thirty-day flow test the deepest zone.	30 days to 35 days
5. Demobilize rig and clean up site.	20 days 20 days
6. Final report.	20 days to 24 days
TOTAL:	160 days to 190 days

TABLE 2: Estimated Time Required for SSSDP Well Deepening and Long-Term Flow Testing (excluding additional time required for removing and replacing parted 7-inch liner).

The present well construction, consisting of a 7-inch liner hung inside 9 5/8-inch casing, is unsuitable for well deepening operations, since several lost circulation zones have not been adequately isolated. Control of these lost circulation zones and removal of a lost experiment package from the well bottom would be required before drilling could continue. In addition to remedial operations to repair current well damage, the well deepening initiative would require cementing the lower section of the 7-inch liner and modifying the hanger for thermal expansion. The cost of these operations, exclusive of the major repair costs, would be about $120,000 and would require 9 days to complete. The options, including cost to repair the well damage, are discussed later in this report.

In assessing the feasibility of deepening the SSSDP well, all possible situations that may arise need to be considered. The feasibility assessment should take into account the following:

1. The drilling and coring rate will be dependent upon temperature increase, additional lost circulation zones requiring cementing and drillability of the formations.

2. The wellbore will need to be cooled to accommodate the logging tools, because their temperature limits will have been exceeded.

3. Renewal of the Bechtel National Inc. contract, which expires in December of 1986, would save 3 to 6 months time and from $150,000 to $300,000 by renewal of subcontracts as opposed to spending additional funds to solicit new proposals.

4. Kennecott's continued participation will require their favorable management review to determine acceptability of the risks involved.

Considering the present poor condition of the well, deepening the well to 13,000 or 14,000 ft, though technically feasible, may be precluded because of cost.

Although only limited experience exists for drilling and coring in hard, higher-temperature rocks at depths exceeding 5,000 ft, it was recently recommended that a drilling plan be formulated based upon new and novel approaches to ultra-deep core drilling. A high-temperature turbo-drill for the positive displacement (elastomer stator) motors has been recommended for the primary drilling assembly. For deep rotary coring, a drilling rig with a tophead (power swivel) drive and TCI roller-cone core bits has also been suggested. Los Alamos National Lab and Smith Tool Co. developed a hybrid version of this type of bit for drilling in granite.

Other tools adapted to higher temperature, magma-hydrothermal regimes could be further developed by experimentation in a temperature regime exceeding 350°C. Given the technological achievements of Stage I of the SSSDP, the attitude towards developing new improved technologies for the more hostile environments remains optimistic.

Several advantages to continuing the project, separate from the scientific benefits, are seen at this time. The first advantage is that accessibility to the well, located on Kennecott Corporation's leasehold, is reasonably assured for 12 months from May 1986. Another very important factor to consider is that the orignial project team is very familiar with the field procedures developed and conditions encountered in the well, but the availability of individual team members becomes less certain with delay of follow-on activities. The DOE/OBES Continental Scientific Drilling Review Group endorsed the well deepening as an opportunity that should not be missed.

Responsibility for follow-on activities is being debated. The Geothermal Technology Division (GTD), Department of Energy (DOE), has taken the position that well deepening activities should be the responsibility of those participants involved in basic scientific research, since the justification is largely scientific. However, additional funds for FY-1986 from these sources were not available and there is, as yet, no decision on funding in FY-1987. The scientific community has solicited funds for continuation of the Salton Sea project through the Congress. The House Subcommittee on Energy Development and Applications responded by inquiring whether or not DOE's Geothermal Technology Division (GTD) could fund the well deepening initiative. The GTD maintained that their goal of penetrating the roots of a known hydrothermal system has been accomplished and that deepening the well is of lower priority in fulfilling the GTD mission. However, $1.3 million has been budgeted in FY 1987 for a long-term flow test and improvement of high-temperature downhole instruments.

The Energy and Water Development Appropriation Bill of 1987 is currently before the House of Representatives. On page 77 of the Bill, funds for the SSSDP have been increased by $2 million from $1.3 million to $3.3 million. The additional $2 million is to be used to deepen the Salton Sea well to a depth of 13,000 to 14,000 ft. The Senate has not yet considered the Bill. However, on a related matter, the Senate scheduled hearings on the Continental Scientific Drilling and Exploration Act (S. 1026) for July 24th.

Long-Term Flow Testing

The second flow test, from the deepest producing horizon, at approximately 10,475 ft (as previously reported), is considered to have been only partially successful. There was evidence during the test that flow from one or more zones behind the liner comingled and, also, that the fluid samples were contaminated. A long-term flow test is, therefore, justified in order to determine the true nature of the formation fluids, competing salinity and temperature effects on fluid-density distribution, and water-rock reactions. Determination of the three dimensional distribution of fluid density would allow modeling of heat and mass transfer, and also delineation of the extent of the reservoir(s) and permeability of the reservoir rocks. Also, with proper isolation of reservoirs, a longer term flow test could determine whether or not lower density fluids occur at greater depths, as suggested by results of earlier tests. The discovery of deep, lower density fluids would imply considerably increased economic potential at depth.

Another benefit of performing a long-term flow test is the opportunity for production technology development. High-temperature logging tools, more durable well construction materials, downhole fluid samplers, improved methods for sampling fluids at the surface, and improved techniques for handling, treating and injecting high-salinity brine are also areas where improvements could be made.

Bechtel has estimated that a long-term flow test would cost $1.3 million, if an injection well for fluid disposal is made available. The costs for well repair were not included. Anticipating joint cooperation with Kennecott, the Geothermal Technology Division plans to provide flow test equipment, a pipeline to an injection well, site support and analysis of data from the long-term flow test. Flow-test equipment may be made available from two Geothermal Loan Guaranty projects.

Well Damage, Prognosis and Repair

On May 28, the temperature tool hung-up between 6,145 and 6,330 ft, suggesting that the 7-inch liner had parted near the bottom of the ninth joint. Preliminary diagnostic testing began on June 25th with two surveys using the Dia-Log Minimum I.D. caliper tool. The logs were of poor quality due to high-temperature, but detected the 7-inch liner from 5,770 to 6,178 ft, a constriction at 6,341 ft and a blockage at 6,422 ft in what otherwise is an open hole between 6,178 and 6,422 ft. On June 26th, the Welex casing inspection tool and collar locator confirmed and amplified the Dia-Log results with minor value differences. The casing inspection log indicated that the liner appeared normal between the hanger and point of failure. The condition of the well, derived from these diagnostic tools, is shown in Figure 1.

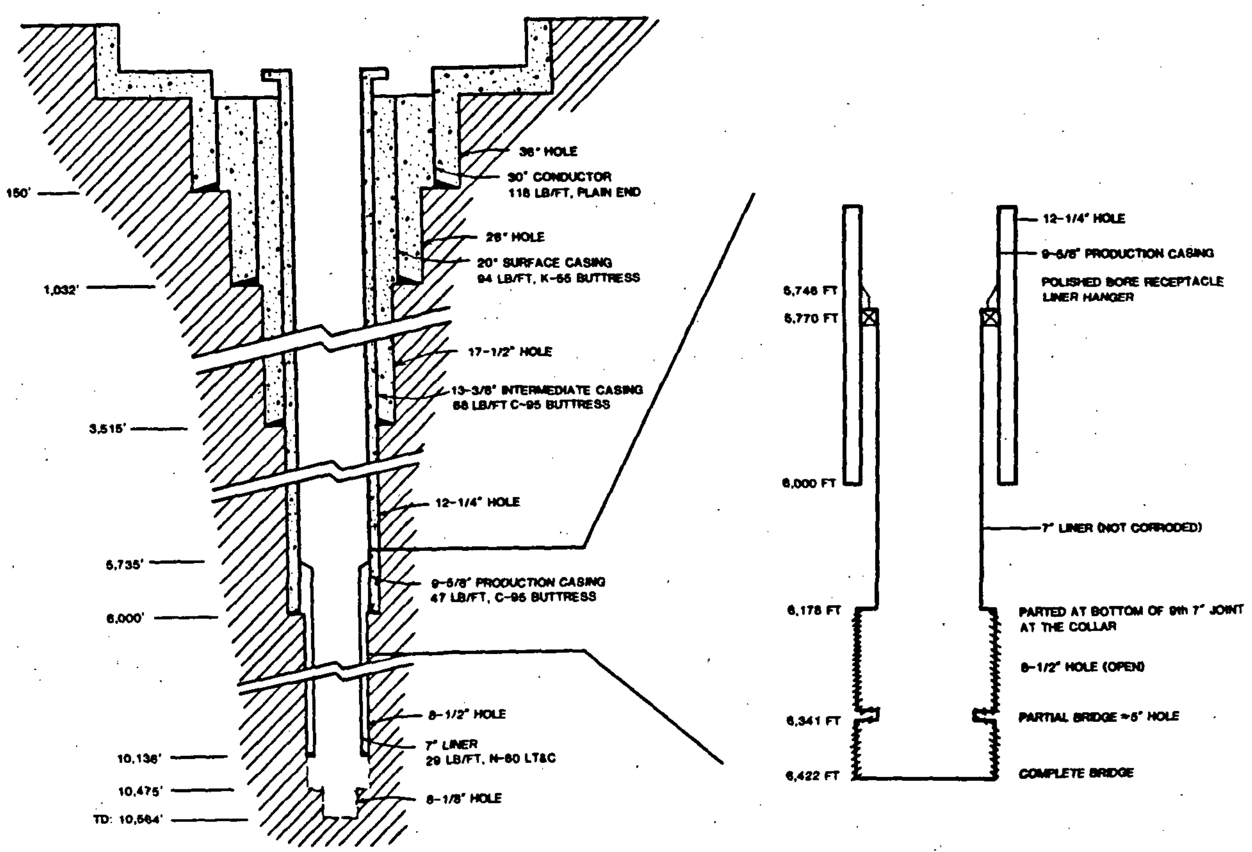

Figure 1: Condition of State 2-14 (SSSDP) Well on June 26th

A total of 4,378 ft of liner was installed. Therefore, it has been assumed that 3,970 ft of the liner has fallen. By differences, it was projected that the bottom of the liner is at 10,392 ft (83 ft above the bottom of the 8-1/2 inch hole and the beginning of the 6-1/8 inch hole). The condition of this section of the liner is unknown.

By June 27, the primary objectives were to (1) diagnose the condition of the lower 4,000 ft of 7-inch liner and repair the well; (2) continue scientific experimentation; and (3) conduct a 30-day flow test and deepen the well. Achieving these objectives will require additional funding and Kennecott's participation.

In order to complete these objectives, the necessary remedial tasks include: (1) pull-out the 7-inch liner between 5,748 and 6,178 feet, and the liner hanger; (2) leave the bottom 4,000 ft of 7-inch liner in-place with the expectation of getting instruments below 6,422 ft to total depth; (3) attempt an "overshot" of the 7-inch liner; and (4) establish the cause of failure and the integrity of the lower section of the well. The three strategies proposed, and summarized in Table 3, assume Kennecott agreement with the procedures, no severe lost circulation problems exist and the fallen 7-inch liner section is either in a usable condition or can be removed from the well.

Option	Minimum Cost (not including rig mobilization costs)	Strategy to Repair the Well	Benefits of the Strategy
1	$155,000	o enter and clean out the broken liner with a 6-inch mill bit to total depth. o insert a 5-inch scab liner between the liner hanger and the top of the fallen 7-inch liner.	permits resumption of the temperature equilibrium study, but not flow testing or drilling deeper.
2	$200,000	o remove the upper hanging part and replace it with an S95, 7-inch liner, connected to the broken stub with an overshot coupling, if the fallen liner is intact and can be cleaned out with a 6-inch mill bit.	permits equilibrium temperature study, and possibly flow testing and deepening, though the possibility of flow testing seems unlikely.
3	$570,000	o remove existing 7-inch liner and replace it. o remove fallen section in four pieces.	permits the temperature study, flow testing and deepening.

TABLE 3: Three Options for Repairing the SSSDP Well

Scientific Experiments Program

Well Deepening Initiative

The most important justification for deepening the well is to extend scientific knowledge of earth's thermal regimes in a unique tectonic setting. The complete loss of circulation below 10,460 ft led project scientists to recognize that the "roots" of the system had not been fully penetrated. Complete penetration of the hydrothermal system would help verify the existence of (1) a considerably deeper heat source, (2) a laterally displaced heat source, or (3) a conductive hot dry rock regime bordering an active dike or sill.

Deepening the well, thus determining the nature of the heat source, is an extremely important scientific goal. Entirely different mineral assemblages may be revealed by penetration of a zone with temperatures greater than the 353°C measured at 10,400 ft. If successful penetration is achieved, a rare opportunity to study the transition from hydrothermal alteration to contact metamorphism and to study more of the magmatic component of the system will be realized. Long-term flow testing from a deeper producing horizon would also enable the study of the effects of higher temperature mineral reactions on brine chemistry.

Downhole Experiments

The DOE National Laboratories conducted several downhole experiments in the SSSDP well to gather data for scientific studies. These post-drilling scientific activities fulfilled both basic science and technology development objectives. Summaries of the DOE National Laboratory activities are provided below.

Los Alamos National Laboratory (LANL): Los Alamos collected fluid samples on the surface during the flow test and obtained one successful downhole fluid sample. Failure to get downhole fluid samples occurred because of:

- 1st run - seal malfunction causing the motor to flood
- 2nd run - seal malfunction causing a short-circuit
- 3rd run - an ailing motor
- 5th run - electrical problems

The 4th fluid sample run was successful, recovering approximately 1.5 liters of fluid and 0.5 liter of gas.

The SSSDP site team ran the commercial (Leutert) mechanically-tripped flow-through sampler three times while Los Alamos and Sandia were making field repairs on the electric sampler. These attempts were unsuccessful because the Leutert sampler design limit was 177°C and the attempts were being made in a 344°C environment.

Lawrence Berkeley Laboratory (LBL): LBL personnel performed the vertical seismic profile (VSP) experiment without major complications. The downhole tool was run on the USGS 7-conductor wireline. Also, the Berkeley (GRI) flow-through sampler was deployed on the USGS single-conductor wireline. About one liter of unpressured liquid was recovered. The sampler remained in the high-temperature downhole environment longer than planned, which could account for loss of the gas sample.

Lawrence Livermore National Laboratory (LLNL): Lawrence Livermore contributed an IBM P.C. and a Terra Station interpretive package for on-site processing and interpretation of well log data. The downhole gravity survey did not run according to plan; however, useful data were obtained.

Sandia National Laboratory (SNL): Sandia personnel supervised the design and construction of several tools and downhole deployment components. They provided the battery packs and dewars. The dewared Kuster temperature and pressure tools were resistant to heat and performed satisfactorily, but the spinner tool stopped before useful data could be obtained. The newly developed dewared, electronic-memory temperature and pressure tool worked successfully. Sandia's current problems basically involve the long-standing technological difficulty of running delicate tools in an extremely hostile environment.

The U.S. Geological Survey (USGS) also ran its own set of downhole experiments. In April and May, the USGS intermittently ran the temperature and pressure tools provided by Sandia. Plots of the temperature logs are shown in Figure 2. Other logs run by the USGS included Caliper, Dual Induction, Acoustic Televiewer, Acoustic Waveform and Gamma Ray/Neutron Logs.

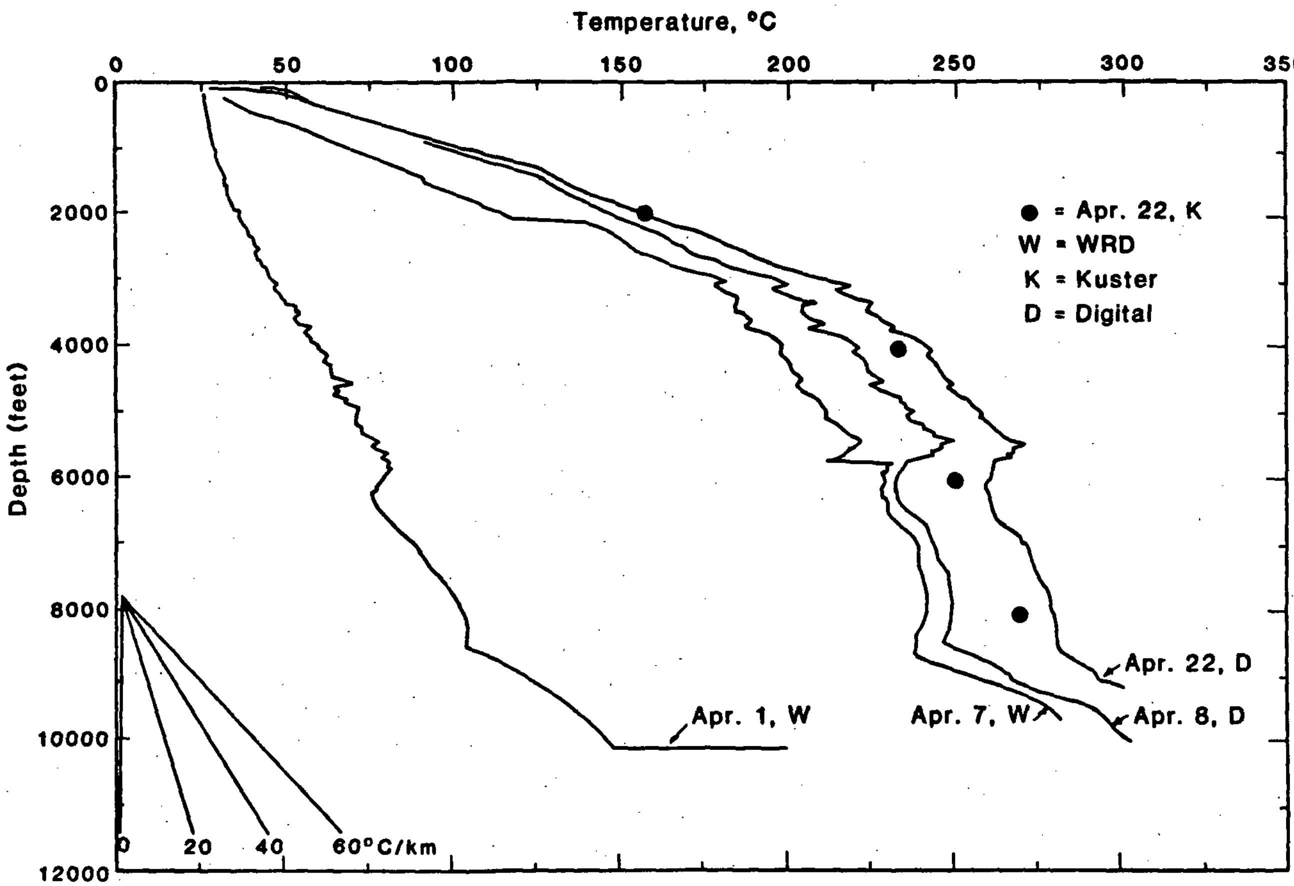

Figure 2: USGS Temperature Logs: State 2-14 (SSSDP) Well

Fluid, Core and Cuttings Samples

Fluid and/or gas samples from the Salton Sea well have been distributed to investigators by Los Alamos National Laboratory. A list of SSSDP State 2-14 fluid and/or gas sample recipients is provided in Table 4.

The Massachusetts Institute of Technology's (MIT) Earth Resources Laboratory and the U.S. Geological Survey have a joint interest in characterizing the physical properties of the SSSDP cores. A DOE/GTD funded study of the relationship between borehole acoustics and seismic velocities of cores at ultrasonic frequencies was recently funded. A proposal to do other core studies will be presented to DOE after a preliminary set of tests on the two representative cores has been performed. Other core and cutting samples from the SSSDP well were distributed to various other laboratories and research groups.

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Table 4: SSSDP California State 2-14 Well Fluid and/or Gas Sample Recipients

Reporting of Scientific Results

Now that the drilling, coring and flow-testing have been completed, distribution is now being made of the samples and data, and scientific results are being compiled and released. Table 5 provides a preliminary bibliography of SSSDP reports that have been published, are in press or are in draft form.

TABLE 5: Preliminary SSSDP Bibliography

* = Status

Aducci, A.J., Klick, D.W., and Wallace, R.H., Jr., 1986, Management of the Salton Sea Scientific Drilling Program; Geothermal Resources Council: Transactions, v. 10, 4 p.

* In press

Andes, J., Jackson, J., Lilje, A., Sullivan, R., and Herzig, C.T., 1986, Salton Sea Scientific Drilling Project, California State 2-14 Well, Visual Core Descriptions; Herzig, C.T. and Mehegan, J.M., eds, Institute of Geophysics and Planetary Physics, University of California, Riverside: UCR/IGPP-86/1, v. 2, April, 93 p.

* Pub.

Carson, C.C., 1986, Development of Downhole Instruments for Use in the Salton Sea Scientific Drilling Project; Geothermal Resources Council: Transactions, v. 10.

* In press

GeothermEx, Inc., 1986, Salton Sea Scientific Drilling Program Flow Test of Well State 2-14, 28-30 December 1985; for Bechtel National, Inc., San Francisco, California, June, 40 p.

* Draft - in Review

GeothermEx, Inc., 1986, Salton Sea Scientific Drilling Program Geologic Interpretation Well State 2-14; for Bechtel National Inc., San Francisco, California, June, 158 p.

* Draft - in Review

GeothermEx, Inc., 1986, Salton Sea Scientific Drilling Program Flow Test of Well State 2-14, 20-21 March 1986; for Bechtel National, Inc., San Francisco, California, June, 71 p.

* Draft - in Review

Harper, C.A., and Rabb, D.T., 1986, The Salton Sea Scientific Drilling Project: Drilling Program Summary; Geothermal Resources Council: Transactions, v. 10.

* In press

Herzig, C.T., and Mehegan, J.M., 1986, Salton Sea Scientific Drilling Project, California State 2-14 Well, Core Summaries; Institute of Geophysics and Planetary Physics, University of California, Riverside: UCR/IGPP-86/2, v. 2, April, 12 p.

* Pub.

Lilje, A., and Mehegan, J.M., 1986, Salton Sea Scientific Drilling Project, California State 2-14 Well, Coring Summaries; Institute of Geophysics and Planetary Physics, University of California, Riverside: UCR/IGPP-86/2, v. 1, March, 33 p.

* Pub.

Mehegan, J.M., Herzig, C.T., and Sullivan, R.M., 1986, Salton Sea Scientific Drilling Project, California State 2-14 Well, Visual Core Descriptions; Institute of Geophysics and Planetary Physics, University of California, Riverside: UCR/IGPP-86/1, v. 1, March, 221 p.

* Pub.

Michels, D.E., 1986, SSSDP Fluid Composition at First Flow of State 2-14; Geothermal Resources Council: Transactions, v. 10.

* In press

Nicholson, R.W., 1986, Extensive Coring in Deep Hot Geothermal Wells; Geothermal Resources Council: Transactions, v. 10.

* In press

Paillet, F.L., Morin, R.H., Hodges, R.E., Robson, L.C., Priest, S.S., Sass, J.H., Hendricks, J.D., Kasamayer, P., Pawlowski, G., Duba, A., and Newark, R., 1986, Geophysical Logging Activity at the Salton Sea Scientific Drilling Project: Preliminary Report, U.S. Geological Survey Open File Report.

* Draft

Sass, J.H., and Elders, W. A., 1986, Salton Sea Scientific Drilling Project: Scientific Program; Bul. Geothermal Resources Council, v. 15, no. 9, p. 21-26.

* Pub.

Sass, J.H., and Elders, W. A., 1986, Salton Sea Scientific Drilling Project: Scientific Program; Geothermal Resources Council: Transactions, v. 10.

* In press

Solbau, R., Weres, O., Hansen, L., and Dudak, B., 1986, Description of a High Temperature Downhole Fluid Sampler; Geothermal Resources Council: Transactions, v. 10.

* In press

U.S. Department of Energy, 1986, Salton Sea Scientific Drilling Program Monitor, 23 October - 6 November 1985, Report, No. 1: Bul. Geothermal Resources Council, v. 15, no. 2, 15 p.

* Pub.

U.S. Department of Energy, 1986, Salton Sea Scientific Drilling Program Monitor, 7 November - 6 December 1985, Report, No. 2: Bul. Geothermal Resources Council, v. 15, no. 2, p. 15-17.

* Pub.

U.S. Department of Energy, 1986, Salton Sea Scientific Drilling Program Monitor, 7 Dec. - 10 Jan. 1986, Report No. 3: Bul. Geothermal Resources Council, v. 15, no. 4, p. 15-18.

* Pub.

U.S. Department of Energy, 1986, Salton Sea Scientific Drilling Program Monitor, 11 Jan. - 10 Feb. 1986, Report No. 4: Bul. Geothermal Resources Council, v. 15, no. 6, p. 25-28.

* Pub.

U.S. Department of Energy, 1986, Salton Sea Scientific Drilling Program Monitor, 11 February - 1 April 1986, Report No. 5: Bul. Geothermal Resources Council, v. 15, no. 8, p. 13-20.

* Pub.

Wolfenbarger, F.M., 1986, Battery Pack/Controller for High Temperature Applications; Geothermal Resources Council: Transactions, v. 10.

* In press

SIGNIFICANT MEETINGS

Continental Scientific Drilling Review Group (DOE/OBES, CSD Review Group) - May 1, 1986

The Continental Scientific Drilling Review Group (CSD Review Group) viewed the Salton Sea Scientific Drilling Program as a tremendous research opportunity. According to the group's observation, having reached 355°C at a depth of 10,500 ft, a hydrothermal region never before available for scientific study was entered. The samples, thus far, have provided a fascinating record of metamorphic transitions from lake muds to hornfels with abundant ore mineralization. High enthalpy, hypersaline (25% dissolved solids), metal-rich brines flowing at up to 260,000 kg/hr have been produced according to tests of high permeability zones.

The Continental Scientific Drilling Review Group was convinced that further drilling, sampling and testing to a depth of 13,000 to 14,000 ft was an opportunity that should not be missed. For the first time, igneous rocks related to the deep heat source of the plate-spreading system could be penetrated and deep hydrothermal resevoirs with temperatures over 350°C could be examined.

A logical sponsor for deepening the SSSDP well would be the Geoscience Program in BES, but the BES budget will not allow this. Therefore, the CSD Review Group urged LBL to forward a strong endorsement to parties interested in the SSSDP.