UNIVERSITY OF DENVER TO PRODUCE DESIGN MANUAL FOR GEOTHERMAL PRODUCTION WELLS

Improving the efficiency of geothermal energy operations will be the objective of a $378,399 research program to be conducted at the University of Denver Research Institute. The two and one-half year project, sponsored by Energy Research and Development Administration, is aimed at providing a manual for the design of geothermal production wells. Since the geothermal industry lacks sufficient information with which to evaluate plant designs and specifications for this type of flow system, the design manual is of major importance to industry development.

Dr. Laurence W. Ross, research engineer in DRI’s Laboratory for Applied Mechanics, is project manager. Dr. Glenn E. Coury of Coury and Associates, Inc., consulting engineers, is responsible for the collection and analysis of field data and the establishment of a field research station. Computer modeling and analyses of alternative geothermal operations will be done at the University of Houston under the supervision of Dr. Abraham E. Dukler.

The manual will permit optimum design specifications of the entire geothermal system, including selection of the producing stratum well diameter profiles, and selection of wellhead pressure and temperature. The calculation procedures will also provide a basis for deciding whether the costs of a pumped system can be justified in any particular case.

The design manual will be developed on the basis of the latest technologies used on geothermal wells which operate in the two-phase flow system.

U. S. GEOLOGICAL SURVEY
OPEN FILE REPORT

The Minor and Trace Elements, Gas, and Isotope Compositions of the Principal Hot Springs of Nevada and Oregon: August 1975, by R. H. Mariner, T. S. Presser, J. B. Rapp, and L. M. Willey. Copies are available from:

Robert H. Mariner
U. S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

OPEN FILE DATA

Geothermal test-hole data; water levels, temperature logs and profiles, and lithologic, gamma, gamma-gamma (density), neutron, and resistivity logs; for 132 holes, generally less than 30 m deep, are open for inspection. Areas covered are: Carson Desert, Buffalo Valley, Brady Hot Springs, Grass Valley, Ruby Valley, and Beowawe, all in north-central Nevada. The files may be inspected at U. S. Geological Survey, Water Resources Division, 345 Middlefield Road, Menlo Park, California; and Nevada District Office, Federal Building, Room 229, 705 North Plaza Street, Carson City, Nevada.
### RAFT RIVER PROJECT

Two deep geothermal wells have recently been completed in the Raft River Valley of Southern Idaho. As part of the Energy Research and Development Administration’s Geothermal Program at the Idaho National Engineering Laboratory, the wells are delivering water approximating the temperature previously predicted by geochemistry (145°C). The following table briefly describes the two wells.

<table>
<thead>
<tr>
<th>State</th>
<th>Location</th>
<th>Number of Wells</th>
<th>Temperature (°C)</th>
<th>Production Rate (gpm)</th>
<th>Total Test Depth (ft)</th>
<th>Future Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho</td>
<td>Bruneau</td>
<td>1</td>
<td>85</td>
<td>5,000</td>
<td>8,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Idaho</td>
<td>Castle Creek</td>
<td>2</td>
<td>75</td>
<td>6,000</td>
<td>10,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Idaho</td>
<td>Frazier</td>
<td>1</td>
<td>75</td>
<td>2,000</td>
<td>3,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Idaho</td>
<td>Mountain Home</td>
<td>1</td>
<td>75</td>
<td>1,000</td>
<td>2,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Idaho</td>
<td>Vulcan Hot Springs</td>
<td>1</td>
<td>75</td>
<td>1,000</td>
<td>2,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Idaho</td>
<td>Yellowstone</td>
<td>1</td>
<td>75</td>
<td>1,000</td>
<td>2,000</td>
<td>200,000</td>
</tr>
</tbody>
</table>

### NEW MEXICO STATE UNIVERSITY ANNUAL ENERGY CONFERENCE

NMU, Las Cruces, New Mexico has announced the program of its Annual Energy Conference. The topic is Geothermal Energy Resources. Topics included in the technical program include the federal leasing program, legislative aspects, hot dry rock technology, resources evaluation, geothermal exploration, and geophysical aspects, among others. For further information about the conference to be held October 10, contact:

Chandler A. Swanson
Assistant Professor Physics/Earth Science Department of Physics
New Mexico State University Box 3D
Las Cruces, New Mexico 88003
Telephone: (505) 645-3931
Geo-Heat Utilization Center

Oregon Institute of Technology
Klamath Falls, Oregon 97601

EPA WORKSHOP ON SAMPLING OF GEOTHERMAL EFFLUENTS

The U.S. Environmental Protection Agency is sponsoring the First Workshop on Sampling Geothermal Effluents, on October 20 and 21, 1975 at the Environmental Monitoring and Support Laboratory, Las Vegas, Nevada. Dissertations will cover “Sampling of Vapors and Liquids, The Need for Standard Methods, Sampling Hazards, and Sampling Methods and Procedures in Use by Various Organizations.” Attendance is limited to 100 persons, and there is no attendance charge. Any person with a unique approach to geothermal sampling, please contact:

George B. Morgan
Environmental Monitoring and Support Laboratory
P.O. Box 1033
Las Vegas, Nevada 89114
(702) 736-2969

FINANCIAL SHORT COURSE TO BE OFFERED

The Geothermal Resources Council has scheduled Special Short Courses for November 7-10. Held October 23-24 at the Holiday Inn on Fisherman’s Wharf, San Francisco. The short course is entitled “Financial Aspects of Geothermal Resources Development.” The two-day session will highlight a number of topics, including exploration, environmental, legal, and institutional barriers; investment opportunities; tax considerations and shelters; financing, drilling and development of a small exploration company; twenty-year potential of geothermal energy; uses of geothermal energy in federal loan guarantee program; and agricultural uses of geothermal heat. Registration is limited to 100 persons and the fees are $140 for non-members, $126 for members, and $25 for students. For further information and registration contact:

Bev Hall
Geothermal Resources Council
P.O. Box 1033
Davis, California 95616
(916) 758-2360

U.S.G.S. RELEASGES GEOTHERMAL RESOURCES ASSESSMENT PUBLICATION

The Department of the Interior has recently announced the publication of U.S.G.S. Circular 726, "Assessment of Geothermal Resources of the United States," edited by D. E. White and D. L. Williams. The 155-page report includes a breakdown of prospective areas of geothermal development, identifying over 60 geothermal systems in the western United States with temperatures above 150°F, and over 200 geothermal systems with temperatures from 90-150°F. Chapters cover such areas as: igneous-related geothermal systems, hydrothermal convection systems, recoverability of geothermal energy directly from molten igneous systems, and assessment of offshore geopressured geothermal resources in the Gulf of Mexico basin.

Recoverable geothermal reserves with present economic technology are estimated to be capable of providing 12,000 MW for 30 years. If economics change and the price obtainable per MW is doubled, it is estimated that recoverable reserves would jump to 125,000 MW installed capacity for 30 years, with new present technology (using mostly the geopressured areas in the Gulf of Mexico).

The report is free of charge, and can be obtained by requesting it from the U.S. Geological Survey, National Center, Reston, Virginia 22092.

USGS OPEN FILE GEOPHYSICAL DATA FOR KGRA'S SCHEDULED FOR LEASE SALE

The U.S. Geological Survey has instigated a new policy of opening geophysical records of KGRAs to the public, 30 days prior to a lease sale. Records may be viewed at U.S.G.S. offices in San Francisco, Menlo Park, Denver, and Reston. By contacting the public inquiries offices of the U.S.G.S. in Denver and San Francisco, the public will determine when geophysical material will be open filed, to prepare for geothermal lease sales. Geophysical data for the Vale Hot Springs, Oregon is already open filed. Data for Steamboat Springs, Nevada is not yet open filed but will be before the date of the sale (probably about 10 days prior to the lease sale).

Information available on Steamboat Springs will include: gravity, spontaneous potential, audio-magnetotelluric, and telluric data. Steamboat Springs information will also be available from the Nevada Bureau of Mines office in Reno. Masters available for copying will be available at the San Francisco and Denver offices of the U.S.G.S.

POSSIBLE GEOThERMAL DEVELOPMENT POTENTIAL IN THE DIABLO RANGE

The Diablo Range, east of Gilroy, California, may be the site of geothermal exploration by Diablo Exploration Inc., of Oakland, if a grant before the Energy Research and Development Administration is approved. The grant would make available $350,000 in exploration costs to the university within three counties: Santa Clara, San Mateo, and Merced. Pete Castellanos, president of Diablo Exploration Inc., plans to direct studies to the feasibility of piping hot waters from potentially productive wells to the Gilroy area for use by the canning industry. However, much preliminary work needs to be done to delimit the extent of the resources before realistic area projections and applications can be made. The area of investigation will range southwards from the Alameda-Santa Clara line to the Mercy Hot Springs area. The City of Santa Clara is a consensor of the project, and coinvestigators are James B. Koening and Tsvi Medav.

Vale hot springs KGRA LEASE SALE, OREGON

The Bureau of Land Management is receiving sealed bids for 6 tracts of land totaling 12,753.83 acres within the Vale Hot Springs KGRA in Malheur County, Oregon. Bids must be submitted to the State Director, Bureau of Land Management, P.O. Box 2965, Pendleton, Oregon 97801 by 1:00 p.m. September 25, 1975. Copies of lease forms, bond forms, regulations, special stipulations, and optional bid forms are available for examination at a Symposium on Bureau of Land Management, at the above address.

KGRA LEASE SALE

Lake City - Surprise Valley

June 23, 1975

Only 5 tracts out of 16 offered were bid upon in the Lake City - Surprise Valley geothermal lease sale June 23. Bidding information follows in the table below.

<table>
<thead>
<tr>
<th>Tract No.</th>
<th>Bidder</th>
<th>Acres</th>
<th>Total Bid</th>
<th>High Bidder</th>
<th>High Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>No Bid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Geysir Oil Co.</td>
<td>1,566.51</td>
<td>29,747.37</td>
<td>18.55</td>
<td>28,742.37</td>
</tr>
<tr>
<td>7</td>
<td>Geysir Oil Co.</td>
<td>1,566.51</td>
<td>29,747.37</td>
<td>18.55</td>
<td>28,742.37</td>
</tr>
<tr>
<td>8</td>
<td>Geysir Oil Co.</td>
<td>1,566.51</td>
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<td>18.55</td>
<td>28,742.37</td>
</tr>
<tr>
<td>9</td>
<td>Geysir Oil Co.</td>
<td>1,566.51</td>
<td>29,747.37</td>
<td>18.55</td>
<td>28,742.37</td>
</tr>
<tr>
<td>10-16</td>
<td>No Bid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: 10,892.49 142,677.25 134,053.19

STILLWATER-SODA LAKE

June 26, 1975

Twenty-one tracts of land were offered at the competitive geothermal lease sale of the Stillwater-Soda Lake KGRA; 6 tracts were bid upon. The following table summarizes the bidding activity:

<table>
<thead>
<tr>
<th>Tract No.</th>
<th>Bidder</th>
<th>Acres</th>
<th>Total Bid</th>
<th>High Bidder</th>
<th>High Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>No Bid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Phillips Phillips</td>
<td>1,250.00</td>
<td>12,958.35</td>
<td>4.75</td>
<td>12,958.35</td>
</tr>
<tr>
<td>7</td>
<td>Phillips Phillips</td>
<td>1,250.00</td>
<td>12,958.35</td>
<td>4.75</td>
<td>12,958.35</td>
</tr>
<tr>
<td>8</td>
<td>Phillips Phillips</td>
<td>1,250.00</td>
<td>12,958.35</td>
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<td>12,958.35</td>
</tr>
<tr>
<td>9</td>
<td>Phillips Phillips</td>
<td>1,250.00</td>
<td>12,958.35</td>
<td>4.75</td>
<td>12,958.35</td>
</tr>
<tr>
<td>10-16</td>
<td>No Bid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: 12,756.75 142,918.92 134,053.19

CRUMP GEYSER

July 31, 1975

Of 18 tracts of land offered at the competitive lease sale of Crump Geyser KGRA July 31, only 4 were bid upon. Churchill Oil Company was the sole bidder on tracts 8, 9, 11, and 14. Total amount bid on 9,462.19 acres, $37,016.21. Average bid per acre was $3.91.

U.N. GEOTHERMAL SYMPOSIUM

World-wide interest, research, and development of geothermal energy is progressing at a significant rate, as evidenced by the volume of papers submitted (nearly 300) and the attendance (over 1,200) of the Second United Nations Conference on the Development and Use of Geothermal Energy held in San Francisco, April 20-29. Registrants from 59 countries attended the Symposium and 129 papers were presented in Spanish, French, and English.

Copies of the abstract volume (containing abstracts of each paper submitted) are available in English, French, or Spanish for $10.00 from:

Robert R. Ounier
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Checks should be made payable to U.N. Geothermal Drilling Symposium.
OREGON LEGISLATION

HB 2040 Declares state policy on geothermal resources. Makes State Geologist responsible for administering laws relating to geothermal resources. Con- 

tracts of jurisdiction between state agen- 

cies appear to be removed by this bill.

status: law, effective July 1, 1975

The revised law should encourage geothermal ex-

ploration in Oregon. - Ore Bin

CALIFORNIA LEGISLATION

AB 1293 Kapiloff and Suit content: Would authorize a tax credit for Cali-

fornia taxpayers involved in pure research and study in preparing for the explo-

ration of geothermal fields, in the applied 

research and development of such fields, 

and of machinery, equipment designed to 

use geothermal energy and convert that 

energy to electrical power.

status: In Revenue and Taxation Committee

AB 1496 Kapiloff et. al. content: Transfers regulatory functions of the 

Division of Oil and Gas and certain func-

tions of the Division of State Lands with 

respect to geothermal resources develop-

ment operations to the State Energy 

Resources Conservation and Development 

Commission. 

status: In Energy and Diminishing Materials 

Committee

SB 105 Roberts content: Would prohibit any oil company with 

more than $2 billion in assets from ac-

quiring, owning or controlling many of 

the State's geothermal energy resources 

(includes geothermal).

status: Failed in Public Utilities, Transit, and 

Energy committee 5/3.

SB 517 Dills content: Would abolish Geothermal Resources 

Board and places its function with the 

State Energy Resources Conservation and 

Development Commission.

status: Passed Senate 6/24, passed Ways and 

Means Committee 8/28.

SCA 20 Dills and Alquist content: Exempts properties containing unus-

able geothermal resources from property 

taxation until the resource becomes usable.

status: In Revenue and Taxation Committee

SJR 65 Nejedly content: Recommends to President, Vice Presi-

dent, and Congress amendment to IRC 

(1954) to authorize deduction of intangi-

ble geothermal drilling costs.

status: Passed Senate; in Assembly Revenue 

and Taxation Committee

NEVADA LEGISLATION

SB 158 An act relating to geothermal resources; providing definitions; 

authorizing the state engineer to adopt 

regulations to control the development of 

geothermal resources of the state, and 

water or steam encountered during ex-

ploration is subject to certain appropria-

tion procedures; and providing other 

matters properly relating thereto.

status: passed; now law.

Nevada's Division of Water Resources is 

currently in the process of drafting rules 

and regulations to control the resources 

in Nevada. The regulations will hopefully 

be completed by the end of this year.

SCR 28 Directs the state engineer to appoint 

a committee to study existing and pro-

posed government-produced brine in-

tions pertaining to the development, 

control and conservation of geothermal 

resources in Nevada.

status: passed, presently in effect.

*WELL OPERATIONS* 

IMPERIAL COUNTY, CALIFORNIA

Salton Sea Test Project
San Diego Gas and Electric Company has started 

construction on its 10 MW pilot project 

in the Salton Sea Geothermal Field (Hot Line, 

May 1975). The U. S. Energy Research and 

Development Ad-

ministration is funding the expenses of the project with 

the Imperial Irrigation District. The 

facility will use steam from 2 existing wells: Imperial Magmas' "Magmamaa" 

1 and "Woosley" 1. The separation and re- 

duction of the brine will be purchased from the 

Imperial Irrigation District. The steam will be directed to 

the public utility companies. The facility will be complete by December 1975.

Westlake Geothermal Area

Union Oil Company of California has completed 

drilling its third well in the Brawley area (Hot Line, 

December 1974). Drilling operations have been tem-

porarily halted, pending testing of the existing wells. 

Surface pipelines and testing facilities are being in-

stalled. Previously, both of the wells showed indications of the characteristics of the three wells. No information has been released to date, concerning reservoir characteristics or flow potential. If permits are obtained, Westlake Geothermal Area will be completed on August 4, 1975 at a depth of 878.4 m. Well 11A-w was spudded the next day and is now being drilled. Shell's first well at Westlake Geothermal was abandoned.

BEAVER COUNTY, UTAH

Roosevelt Hot Springs KGRA

Phillips Petroleum Company is drilling its fourth 

well on federal leases in Utah. Well 9-1 located 305 

m south and 780 m west from the northeast corner of 

Sec. 9, T. 7 S., R. 9 W., S.L.B.M. on BLM lease 

U-27388 was completed on April 30, 1975 at a depth of 

2098.6 m. Well 9-3 located 953.7 m south and 

777.2 m west from the northeast corner of Sec. 3, T. 

11 N., R. 8 W., S.L.B.M. on BLM lease U-1386, was 

completed on May 23, 1975 at a depth of 831.49 m. 

During testing, the well produced 94,000 kg/hr of 

mixed steam and water at a temperature above 

200°C. Well 54-3, located 759 m south and 740.7 m 

west from the northeast corner of Sec. 3, T. 27 S., R. 9 W., S.L.B.M. on BLM lease 

U-27386 was completed on April 1, 1975 at a depth of 878.4 m. Well 12-35, located 228 m south and 303 m east from the northeast corner of Sec. 3, T. 11 S., R. 8 W., S.L.B.M. on BLM lease U-27386, was spudded on August 6, 1975 and is now being drilled.

NOTE: Federal geothermal wells will be numbered on a modified Kettleman system. Well numbers in parentheses will be changed.

SANDALO COUNTY, NEW MEXICO

Union Oil Company

On Apr. 17, 1975 Union Oil Co, of California conducted a press tour of its Baca Land Grant lease where Union has an exploration drilling program in the 

Re conduco Canyon Area of the Valles Caldera. At that time, drilling was continuing in well "Baca" 16 at a depth of 885.4 m on the way to a proposed total depth of 1,830 m. The well is located 2.933 

m and is the twelfth well drilled by Union since en-

tering the joint venture in 1970. Three of the previous wells have commercial po-

tential and are capable of producing at least 45,000 kg/hr of separated steam. Two other wells are marginal producers. At least 10 wells with commer-

cial potential will be needed for a proposed 50 MW 

plant. The area drilled so far, approximately 405 km², lies within Baca Land Grant leases 

that will be evaluated by January 1, 1976. If the decision is made to develop the area, at least 3 years will be needed for completion of the power plant. Public
Service Company of New Mexico and Plains Electric Generation Co-op have both shown interest in building the electric generation facilities, or Union may build the entire system.

These exploratory wells have been drilled as deep as 2,740 m, and range in cost between $600,000 and $900,000 each. The geothermal reservoir contains hot water above 260°C. Steam is separated at the surface at a temperature of 180°C and with an absolute pressure of 10.5 bars. Union Oil Company has located a large reservoir of hot rock and hot water, but fractures must be intersected by the wells to provide the high flow rates needed. For more information see "Hot Line" v. 4, no. 1, Feb. 1974.

BAJA CALIFORNIA, MEXICO

Cerro Prieto Geothermal Field
Two geothermal wells drilled at Cerro Prieto have greatly increased the area of production. Well M-51 was drilled about 2 km south of the power plant during September 1973; and in March 1975, well M-53 was drilled approximately 2 km east of the power plant. M-53 produces from depths of 1,800 m to 2,000 m and has a recorded bottom hole temperature of 344°C. A maximum, flowing wellhead pressure of 75.2 bars and a separated steam flow of 68,000 kg/hr have been reported from separate tests on the well.

ANTOFAGASTA, CHILE

El Tatio Geothermal Field
Three large-diameter producing wells have been drilled into the 800 m to 900 m deep geothermal zone at El Tatio and separated steam equivalent to 18 MW of electricity was obtained. The productive zone consists of late Cenozoic ignimbrites and flows containing water at a temperature of 265°C. A low resistivity anomaly thought to reflect the presence of hot water covers an area of 30 km².

STATE OF CALIFORNIA
DIVISION OF OIL AND GAS
1416 NINTH STREET, ROOM 1316-35
SACRAMENTO, CALIFORNIA 95814

NORTHERN LATIUM, ITALY

Cesano Area
Ente Nazionale per L'energia Elettrica (ENEL) drilled well "Cesano" I in January 1975, 20 km north-northwest of Rome. This was the first well on the southern border of the Baccano Caldera. The well is producing from a sedimentary section beneath 1,000 m of volcanic rocks, and the reported bottom hole temperature is 210°C. Estimated flow rates are 50,000 kg/hr of separated steam and 150,000 kg/hr of separated water at a flowing wellhead gauge pressure of 10 to 12 bars. The separated water is a sodium, potassium, chloride, sulfate type with 356,000 mg/l dissolved solids.

SMALL GEOTHERMAL POWER PLANT WORKSHOP

NATO'S Committee on Challenges of Modern Society is holding its second Small Geothermal Power Plant Workshop September 8 - 11, 1975 at Sao Miguel, Azores. The workshop is jointly sponsored by the U. S. Energy Research and Development Administration and the government of Portugal. The plan is to lay ground work for a pilot geothermal plant to be constructed in the Azores. Tsvi Meidav of Geonomics, Inc.; James T. Kuwada of Rogers Engineering Co., Inc.; and Andy Lundberg of Lawrence Livermore Laboratory are among the slated speakers.

NEVADA GEOTHERMAL WELL LIST

An up-to-date list of geothermal exploration wells in Nevada is available, listing the name, location, API number, depth, and completion date. The list is available for $5.00 from Arlene Kramer, Publications Office, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada 89507.

-Larry Garside