

memorandum

DATE: DEC 15 1981

REPLY TO: San Francisco Operations Office/GED
ATTN OF:

SUBJECT: RESERVOIR DATA, HEBER PROJECT

TO: Tom Heenan, Director, GED/SAN
Art Wilbur, Project Manager, DOE/GDPP

We are really dealing with unitized operation of the entire Heber Reservoir. *In order to judge the feasibility of the "Donut" heat sweep scheme, prior to developmental drilling of the production and injection islands, and as the reinjection scheme is put into practice, all reservoir data is required. **The reservoir development concept is for exploitation of the entire unit as a whole. Likelihood of success (beforehand), the dynamics of actual flow patterns in the DOE sector of the reservoir, and the potential long-term sweep of heat from the reservoir rock by reinjected fluids require complete info from all wells drilled, logged, tested, produced and injected.

DOE should be willing to negotiate proprietary rights to data for sectors other than DOE-SDG&E's. This will require rigid data handling controls within DOE, LBL & DOE consultants.

for William Holman

Martin W. Molloy
Senior Program Coordinator
Geothermal Energy Division

All the data will still not establish whether the production-injection strategy will work for more than 5-10 years.

Reports (and by implication Union's data gathering) do not seem to be directed toward what I consider to be the significant issues regarding the proposed production-injection strategy. e.g. tracer measurements.

William Holman

William Holman
Geothermal Loan Guaranty Office

Need to identify issues
↓
MEASUREMENTS (DATA)
↓
ANALYSES REQUIRED
M

**Info delivered simultaneously to DOE
Analyses delivered as submitted to Unit Operator

memorandum

DATE December 8, 1981.

REPLY TO Geothermal Demonstration Power Plant Projects
ATTN OF (GDPP) - SAN Operations

SUBJECT RESERVOIR DATA, HEBER PROJECT

TO Dennis Feck, Geothermal & Hydropower Division/HQ

Attached is Union's transmittal letter and draft list of data which Union expects to be willing to provide to DOE for an as yet undetermined price. In addition to the information in the attachment, Union has advised me that the offered well data will be only for wells directly related to this Project; we would not have access to any data from any other activities at the reservoir.*

I would appreciate Program Office assessment of the degree to which data according to the attached list would enable us to satisfy the relevant Program objectives. By copy of this memo, I am asking for a similar assessment from GED/SAN. Similarly, by separate letter, I am asking IBL for an assessment of the adequacy of these data for reservoir modelling and performance predictions.

Art Wilbur
Arthur C. Wilbur
Project Manager

Encl: Ltr, Lindwall to Wilbur, 12/4/81

cc: W. Manning, MO/SAN (w/o encl)
T. Heenan, GED/SAN (w/encl)
D. Liddell, OCC/SAN (w/encl)

*12/11/81
Heber Reservoir*

*Tom/ART: We are really dealing with ~~the~~ UTILIZED OPERATION OF THE ENTIRE RESERVOIR. * IN ORDER TO JUDGE THE FEASIBILITY OF THE DONUT HEAT SWEEP SCHEME, PRIOR TO DEVELOPMENTAL DRILLING OF THE PRODUCTION AND INJECTION ISLANDS, AND AS THE REINJECTION SCHEME IS PUT INTO PRACTICE, ALL RESERVOIR DATA IS REQUIRED. THE RESERVOIR DEVELOPMENT CONCEPT IS FOR EXPLOITATION OF THE ENTIRE UNIT AS A WHOLE. LIKELIHOOD OF SUCCESS (BETTERHAND), THE DYNAMICS OF ACTUAL FLOW PATTERNS IN THE DOE SECTOR OF THE RESERVOIR, AND THE POTENTIAL LONG-TERM SUBSIDY OF HEAT FROM THE RESERVOIR ROCK BY REINJECTED FLUIDS REQUIRE COMPLETE INFO. FROM ALL WELLS DRILLED, LOGGED, TESTED, PRODUCED AND INJECTED.*

DOE SHOULD BE WILLING TO NEGOTIATE PROPRIETARY RIGHTS TO DATA FOR SECTORS OTHER THAN DOE-SDGE'S. THIS WILL REQUIRE RIGID DATA HANDLING CONTROLS WITHIN DOE, IBL & DOE CONSULTANTS.

INFO DELIVERED SIMULTANEOUSLY TO DOE ANALYSIS " AS SUBMITTED TO UNIT OPERATOR.

M

Union Geothermal Division

Union Oil Company of California
Union Oil Center, Box 7600, Los Angeles, California 90051
Telephone (213) 977-6369
RCL81-301



Richard C. Lindwall
Manager of Planning
and Valuation

December 4, 1981

Mr. Arthur C. Wilbur
Project Manager
Geothermal Demonstration Power Plant
Department of Energy
Project Office
110 West A Street - Room 460
San Diego, CA 92101

Dear Art:

Enclosed is a revised list of data to be offered to DOE in conjunction with SDG&E's proposed binary cycle plant at Heber. The revisions from the previous list are intended to address the concerns which Chevron had expressed. I'll keep you advised should they have any additional problems with this new list.

Before you release this list to others in DOE, I would prefer to discuss it with you by telephone.

Very truly yours,

A handwritten signature in cursive script, appearing to read "RCL".

Richard C. Lindwall

RCL:mcm

DRAFT
RCL/ss
WP-0251
12/4/81

The following data list indicates the general scope of the data and information to be included in the various reports to be delivered under this agreement. It should be understood that Union is not obligating itself to obtain any of the specific information or data contained in this list, but, to the extent that such data and information is obtained in the course of normal commercial practices in the development and production of the Heber geothermal resource as related to SDG&E's Plant 1, Union does obligate itself to include such data in the appropriate reports.

A. Existing Data

1. Site and Reservoir Section of SDG&E Proposal

Pages 1-5 through 1-66 of Volume III of the December 1979 Proposal by SDG&E to DOE were submitted in confidence. This section of the Proposal will be released as existing data.

2. Well Completion Reports

(See description under paragraph B below.) Well Completion Reports will be prepared for the _____ existing wells drilled by the Unit participants within the Heber Unit Area.

B. Well Completion Report

As part of normal commercial practice, the data and

information listed below will be collected during well drilling. Within sixty (60) days following the drilling of each well, a Well Completion Report will be prepared which will include all of the resulting data, logs and information for that well.

1. A five-pen geograph will be installed on the rig floor and will continuously record the rate of bit penetration, the weight of the drill string, the rpm of the rotary table, and the mud pump discharge pressure and stroke rate.
2. Physical properties of the drilling fluid will be measured at least once every twenty-four (24) hours during the mud drilling portion of the hole and recorded in the daily mud reports maintained in the drilling foreman's office. These properties consist of mud weight, mud viscosity, mud gel strength, water loss, filter cake thickness, and pH of the mud.
3. The flowline temperature of the mud returns and the temperature of the mud pumped into the well will be continuously recorded using temperature probes and twenty-four (24) hour chart recorders.
4. Directional surveys will be run when the inclination exceeds five degrees (5°). The frequency of the surveys will be dictated by the wellbore trend.

5. Samples of the wellbore cuttings will be obtained as specified in specific well drilling programs. At the completion of the well, a lithologic log will be prepared. The log will contain the following data:
 - a. the penetration rate
 - b. a lithologic description of the wellbore drill cuttings
 - c. mud flowline and pump suction temperatures.
6. Core assemblies will be run in selected wells. The cores will be analyzed to determine the following:
 - a. porosity
 - b. density
 - c. permeability
 - d. specific heat of selected samples saturated with brine.
 - e. thermal conductivity of selected samples saturated with brine.

- f. coefficient of thermal expansion of selected samples saturated with brine.
 - g. compaction coefficient of selected samples saturated with brine.
 - h. Triaxial deformation measurements on selected samples and, if warranted, S-wave and P-wave velocities.
7. Electric logs required for well evaluation and completion will be obtained.

C. Well Test Report

Following the drilling of each well and periodically thereafter, wells will be tested for production or injection characteristics as appropriate. Within sixty (60) days following each such test, a Well Test Report will be prepared containing all of the data resulting from the testing practices listed below.

- 1. Static pressure and temperature surveys will be run by wireline periodically until the wellbore has come to equilibrium.

2. Wellhead productivity will be determined by a pump test or by flowing the well through a test separator. During the test, total mass flow rate, steam rate, and residual water rate will be determined. Wellhead pressure and temperature will also be recorded during the test.
3. Samples of the produced fluids will be collected and analyzed for chemical composition.
4. At the conclusion of the test, a bottom-hole or pump level pressure buildup will be made.
5. Injectivity tests shall be run on injection wells by measuring the injection rate and wellhead pressure and temperature. During an injection test, pressure and spinner surveys may be run in the well. At the conclusion of the injectivity test, a bottomhole pressure falloff survey will be run.

D. Production Report

The production data listed below will be acquired during operation of the power plant, and will be included in a monthly Production Report.

1. The total mass-flow rate and wellhead pressures and temperatures will be recorded.
2. The fluid injection rate and wellhead pressure and temperature will be recorded.
3. The flow rate, temperature and pressure of the fluid entering the plant will be continuously recorded.
4. As often as appropriate, pressure buildups will be run during the scheduled shutting-in of any producing well and pressure falloffs on any injection well shut-in.
5. Injection wells will be surveyed annually using commercially available logging tools to determine the location and relative distribution of the injected fluids leaving the wellbore.
6. Selected shut-in observation wells will be monitored for pressure interference using the Sperry Sun pressure monitoring equipment or equivalent. This information will be deliverable only to the extent that it is directly related to operation of Plant 1.
7. The fluid entering the power plant, will be sampled periodically and analyzed for chemical constituents.

8. Changes in the field-wide fluid chemistry will be determined by sampling and analyzing the produced fluids from each well at least once a year. The analyses will be the same as that of the initial flow test, so that comparisons can be made.
9. Every production and injection well will have its innermost casing inspected at least once every two years using a caliper tool, or equivalent, to monitor casing corrosion.

E. Pump Performance Report

A report will be prepared semi-annually which will document the operating performance, maintenance requirements and design features or changes of downwell production pumps for the preceding six months. The results of special pump tests will also be documented in the report.

F. Environmental Assessment Report

An Environmental Assessment Report will be prepared on an annual basis which will be a compilation of environmental reports and data relating to the Heber Unit Area. These reports will consist primarily of material which had been

submitted to concerned regulatory agencies during the preceding year. Likely topics to be covered in the reports are the following:

1. Subsidence monitoring
2. Seismic monitoring
3. Water quality monitoring
4. Groundwater hydrology

Project Reporting

<u>DOCUMENT</u>	<u>REPORTING FREQUENCY</u>	<u>PRICE</u>
HISTORICAL DATA	O	\$
WELL COMPLETION REPORT	A	\$
WELL TEST REPORT	A	\$
✓ PRODUCTION REPORT	M	\$
✓ PUMP PERFORMANCE REPORT	S	\$
ENVIRONMENTAL ASSESSMENT REPORT	Y	\$

Reporting Frequency

- A - As Required and Updating
- M - Monthly
- O - One-Time (at Beginning of Contract)
- S - Semi-annually
- Y - Yearly