MASTER

IMPERIAL COUNTY

DOE/ET/27196--T3

GEO THERMAL DEVELOPMENT

QUARTERLY REPORT

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April 1, 1980/June 30, 1981

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IMPERIAL COUNTY

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April 1, 1981/June 30, 1981

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FORWARD

IMPERIAL COUNTY

GEOHERMAL DEVELOPMENT QUARTERLY REPORT

April 1, 1980 to June 30, 1981

This quarterly report will show the current progress on Cooperative Agreement DE-FC03-79ET27196 and Geothermal progress in Imperial County. It was prepared by the Director of Public Works and the Geothermal Coordinator as partial fulfillment of this Cooperative Agreement. The report will be broken down into three areas: Geothermal Administration, Geothermal Planning; and other Geothermal Activities.

Geothermal Administration will address the status of the Imperial Valley Environmental Project (IVEP) transfer, update of the Geothermal Resource Center, and findings of Geothermal field inspections. Field inspections will cover the four new wells drilled by Magma at the Salton Sea in preparation for 28 MW power plant, the progress at Sperry at East Mesa, and the two on-line power plants in East Mesa and North Brawley. Evaluation of cooperative efforts will cover the Geothermal Subsidence Detection Network Resurvey, Master EIR for the Salton Sea and the Annual Imperial County Geothermal meeting. The status of Geothermal development throughout the County will cover existing proposed facilities. The summary of the Geothermal meeting (Appendix A) will also provide the status of several projects.

Geothermal Planning will address the EIR Notice of Exemption from CEQA, progress on the Master EIR for the Salton Sea, and the EIR for Phillips Petroleum for 6 exploratory wells in the Truckhaven area.

Other Geothermal Activity will address the Department of Energy Region IX meeting hosted by Imperial County, the Annual Imperial County Geothermal meeting, Class II-1 geothermal hazardous waste disposal siting study, and Imperial County Geothermal Direct Heat Study.

Lastly, it should be noted that the summary of the Imperial County Geothermal meeting (Appendix A) provides an update on many projects and the quarterly report on Imperial County Direct Heat Study (Appendix B) bear reviewing.

IMPERIAL COUNTY
GEOTHERMAL DEVELOPMENT QUARTERLY REPORT

April 1 - June 30, 1981

This report will cover all significant Geothermal development which has occurred in Imperial County during this period. It will follow the format suggested in the Department of Energy Cooperative Agreement DE-FC03-79ET27196 consisting of three major headings: Geothermal Administration; Geothermal Planning; and Other Geothermal Activities.

I. Geothermal Administration is the task of the Geothermal office based within the Department of Public Works under direction of the Director of Public Works. It is responsible for the transfer of the Imperial Valley Environmental Project (IVEP), updating of the Geothermal resource center, conducting Geothermal field inspections, and monitoring Geothermal development. Progress in these areas is as follows:

- A. Status of IVEP transfer. Lawrence Livermore Laboratory's (LLL) summary is found in a two volume study titled, "An Assessment of Geothermal Development in the Imperial Valley of California, Volume 1 and 2". The individual data that went into the report is still on file at LLL. A plan is being developed to transfer the raw data for a future updating program.
- B. Update of the Geothermal resource center. All books and magazines received on Imperial Valley are cataloged in the Resource Center. A plan is being developed for review of seismic data which will be submitted by the users of the micro seismic monitoring network at Brawley (KGRA) and Heber (KGRA).

C. Results of field inspections. During this period, Magma has drilled four wells. Sperry at East Mesa has prepared the well for the down hole pump tests. Magma and Southern California Edison power plants keep producing electricity.

1. In preparation for a 28 MW power plant at the Salton Sea, Magma has drilled four new wells. Magma Max 6 to 3,000 feet; Magma Max 8 to 3,000 feet; Elmore 2 to 3,500 feet; and Barretta 1 to 3,500 feet. They have also worked over Magma Max 2 and Magma Max 3 and Woolsey 1. Lastly, they abandoned Magma Max 1. They are preparing for a 28 MW power plant to go on line July of 1982.
2. Sperry has developed the well and surface equipment needed for testing a down hole pump. They had Maddox Company work over the well using an IDECO work-over rig. On June 30, just before the pump was to be installed, the well liner collapsed at 500 ft. The situation is being studied at this time.
3. 10 MW dual flash plant at North Brawley was down in June for annual turbine inspection. It is now operating. It has been operating for one year. The Magma 10 MW binary power plant at East Mesa is operating at 6 MW. They are gathering data. They have ordered a new turbine and heat exchanger which will be delivered the end of the year.

D. Evaluation of cooperative efforts between industry and the County for Geothermal development in the area. The effort is typified by listing a few of the transactions for this period:

1. Geothermal subsidence detection network resurvey. This 438 mile resurvey is complete. The participants were listed in the last report and the results of the resurvey are brought out in the summary of the geothermal meeting (Appendix A).

2. Meeting with developers on possible green house siting in Imperial Valley.
3. Master Environmental Impact Report for the Salton Sea is a joint effort discussed elsewhere in this report (Appendix A).
4. Annual Imperial County Geothermal meeting June 4-5, 1981, the Summary of which is attached (Appendix A).
5. Cooperative effort with several cities for submission of HUD/DOE proposals for district heating and cooling. There were three cities that submitted proposals, none of which were selected.

E. Problems in Geothermal development and recommendations for action.

1. The one problem concerning the Valley is availability of class II-1 geothermal hazardous wastes sites. On December 18, 1980, IT Corporation opened a class II-1 site. Because of ensuing problems and public concern the County commenced looking at possible class II-1 alternate sites. This has resulted in several public meetings on the initial draft of this study.

F. Status of Geothermal exploration, development, and production in the Imperial County. Currently there are two 10 megawatt power plants on line, with approval for five more. There are three companies drilling wells and three development companies expanding field development. The status of all these will be discussed in four sections: Power Plants; Field Development; Direct Heat Projects; and, Other Projects.

1. Power Plants

The Southern California Edison/Union 10 MW power plant in Brawley is operating as mentioned earlier. They are commencing construction of a 10 MW plant near Salton Sea. It will be on line in July, 1982. The Magma Power 10 MW binary plant is operating at 6 MW. The turbine has been rebuilt. They have repaired leaks in the heat exchanger. Magma Power has drilled four new wells and started construction of a 28 megawatt dual-flash power plant at the Salton Sea near the former loop facility (Geothermal Loop Experimental Facility). The facility has been torn down with the exception of the clarifier. Southern California Edison is renegotiating with Chevron on steam for a 45 megawatt power plant at Heber which is scheduled to be on line in 1984. San Diego Gas and Electric has approval for a 45 megawatt binary plant which is due to go on line in 1985. Republic Geothermal has wells at East Mesa for a power plant and is negotiating with Los Angeles Department of Water and Power for a 10 MW/4 MW plant.

2. Field Development

During this period, Occidental Petroleum has drilled another well at the East Brawley area. Phillips is designing test equipment for flow testing the three wells that they have completed in East Brawley and Magma completed the drilling of the four wells at the Salton Sea.

3. Direct Heat Use

Holly Sugar project, TRW consultant, completed their first well in the South Brawley area. It had a temperature of 370 degrees but a low flow rate of 2 gallons per minute. The City of El Centro's heating and cooling project, WESTEC consultant, will

drill its first well in September. California Energy Commission is funding a possible rose green house using hot water in the Niland area. WESTEC also did an alfalfa drying project for Handlers.

4. Other Projects. The Sperry project had a liner collapse into the well at 500 feet. The course of action is now being decided. MAPCO is completing negotiations with Republic Geothermal splitting joint leases in North Westmorland, but maintaining joint venture in South Westmorland.

II. Geothermal Planning

Geothermal planning is the task of the Geothermal Planner based within the Planning Department under the direction of the Planning Director. Responsibilities are: Geothermal applications; hearings permits; preparing draft environmental impact reports (EIR's); and, implementing the Geothermal element to the general plan. Progress this period was as follows;

A. EIR Notice of Exemptions from CEQA

1. April 9, 1981, Chevron granted Notice of Exemption for 17 shallow temperature observation holes (500 feet in depth).
2. April 29, 1981, Union Geothermal granted a Notice of Exemption for 5 shallow temperature observation holes (1,000 feet).

B. Other Geothermal Planning Activities.

1. Work in progress on an EIR for Phillips Petroleum in the Truckhaven area for up to 6 exploratory wells. Draft EIR due to be completed in July.

2. Master EIR for the Salton Sea KGRA which includes the EIR for a Magma power plant (49 MW) is in progress. The draft will be completed in July.
3. The current Geothermal Planner will be leaving the Planning Department July 17, 1981, a replacement is being recruited for.

III. Other Geothermal Activities.

This quarter four additional activities need to be addressed:

The Region IX Department of Energy meeting in El Centro; the Annual Imperial County Geothermal meeting; the Class II-1 Geothermal Hazardous Waste Disposal Site Study; and the Imperial County Geothermal Direct Heat Study being conducted by VTN Incorporated.

- A. On June 3, 1981, there was a Region IX Department of Energy meeting held in El Centro. This meeting brought together the DOE funded projects from five states; Hawaii, Nevada, Arizona, New Mexico, and California. This one-day meeting summarized the progress to date and the transition from Department of Energy funding. In Hawaii where the Department of Energy is funding three positions, the State has approved the funding of six positions. In Nevada, the Department of Energy State office is being reduced at least 50%; in Arizona there has been much geothermal assessment, but no geothermal wells drilled. The University of Arizona has been very active and will be seeking other funding to continue. One key project is geothermal heating of Williams Air Force Base, which could possibly be picked up by the Department of the Defense. In New Mexico, Department of Energy, is funding the first 50 MW geothermal power plant.
- In California the GRIP's Commission which represents the four geyser area counties will end in October because the counties are not funding it. California direct heat projects will be seeking

funds from California Energy Commission who have AB1905 funds available. Electrical generation and progress in Imperial Valley are such that the Department of Energy reduction will slow development a little, but not stop development. Currently, the Senate has adjusted the budget to continue funding the San Diego Gas & Electric Heber binary power plant.

This meeting also provided five states with the opportunity to visit the Valley sites and Cerro Prieto and attend the two day Imperial County Geothermal meeting to hear, first hand, the progress of all the developers in the County.

- B. Imperial Valley Annual Geothermal meeting was held on June 4-5, 1981 (Appendix A). It showed that the next power plants to come on line will be the Magma 28 MW and Southern Cal Edison 10 MW, both in the Salton Sea KGRA, that the Geothermal Subsidence Detection Network has been completely resurveyed, the identification of the two new KGRA's, the fact that both 10 MW power plants are now operating successfully and that the Division of Oil & Gas will have a local office here after July, headed by Dick Corbaley.
- C. In April, the Geothermal Coordinator completed a study (Potential Class II-1 Geothermal Disposal Sites in Imperial Valley). This study identifies potential Class II-1 sites throughout the Valley. This study is currently being reviewed at local citizen groups meetings. Their concerns will be addressed in the study, which will then go to the Board of Supervisors.

D. The Imperial County Geothermal Direct Heat Study being conducted by VTN Incorporated is one-quarter complete (Appendix B). The summary indicates that the first two tasks to be completed by the Ben Holt Company are complete. Preliminary investigation, with some direct heat users indicated interest in geothermal heat, but indicated that energy costs were only one of the factors in a business. The developers of the resource should have basic understanding of the direct heat use that they are going into. For instance, freeze dry operations should only be under taken by someone with experience in the freeze drying business.

IV. Summary.

This quarterly report was divided into three sections; Geothermal Administration; Geothermal Planning; and Other Geothermal Activities.

The Geothermal Administration progress is as follows:

Lawrence Livermore Lab summation of data titled, An Assessment of of Geothermal Development in Imperial Valley of California, has been published.

The Geothermal resource center is completed, plans are underway for inclusion of the seismic data from the micro seismic monitoring network at Brawley KGRA and Heber KGRA.

The status of field inspection and current progress - Magma power drilled four new wells to approximately 3,000 feet and reworked three other wells in preparation for a 28 MW power plant expected on line June 1982. Sperry Company had the test well reworked but had the liner collapsed just prior to installation of the down

hole pump, the 10 MW dual flash plant at North Brawley and the 10 MW binary power plant at East Mesa are operating at this time (Magma at 6 MW).

Evaluation of cooperative effort between industry and the County were geothermal development. The 438 mile of resurvey of Geothermal Subsidence Detection Network was completed in May. There were meetings with several green house operators. The Master EIR for the Salton Sea will be completed in draft form in July. The Annual Imperial County Geothermal meeting was June 4-5, 1981 (summary attached - appendix A) and a cooperative effort to help several cities with a HUD proposal for district heating and cooling.

Problems in geothermal development and recommendations for action - The current problem is the guaranteed availability of a Class II-1 geothermal hazardous waste site. The County is conducting a siting study and is currently meeting with citizens of Imperial County for their inputs.

Status of Geothermal exploration development and production in the County - Two 10 MW power plants on line; Southern Cal Edison and North Brawley and Magma at East Mesa. Construction underway on Magma 28 MW power plant and Southern Cal Edison 10 MW plant at Salton Sea, both expected to be on line 1982. Southern Cal Edison 45 MW dual flash plant permitted at Heber scheduled to be on line 1984 is renegotiating with Chevron on the price of steam because of the denial by the Public Utility Commission. San Diego Gas & Electric 45 MW binary plant is scheduled to go on line in 1985 has had funding for next year reestablished. Republic Geothermal is still negotiating for a power plant at East Mesa.

Occidental Petroleum has drilled another well at East Brawley "Emanuelli" 1, Phillips has designed test equipment for flow testing at three wells they have completed in East Brawley. Holly Sugar project (TRW consultant) completed the first well with the appropriate temperatures 370 degrees and unacceptable flow rate of 2 gallons per minute. The City of El Centro expects to have their well drilled in September 1981, the California Energy Commission is funding a possible rose green house in the Niland area. WESTEC completed a alfalfa drying project for Handlers, Sperry project has hit a set-back because of liner collapse at 500 feet in the well, MAPCO is completing negotiations with Republic Geothermal on splitting joint leases in North Westmorland.

The Geothermal Planning progress this period was as follows:

EIR Notices of Exemptions for shallow temperature observation holes were granted to Chevron for 17 wells (500 feet in depth) and Union for 5 wells (1,000 feet). Work is in progress on an EIR for Phillips Petroleum to drill 6 exploratory wells in the Truckhaven area. The Master EIR for the Salton Sea KGRA, which includes the EIR for the Magma 45 MW power plant at the Salton Sea, is expected to be completed in draft form in July. The current Geothermal Planner will be leaving July 17, 1981.

The Other Geothermal Activities were as follows:

A June 3, 1981 Region IX Department of Energy meeting was held in El Centro. This brought together representatives from DOE funded projects in Hawaii, Nevada, Arizona, New Mexico, and California for a one day meeting summarizing the progress to date and the transition from the Department of

Energy funding. The state of Hawaii will pick up the funding of their energy office and increase positions from 3 to 6. California Energy Commission has ABL905 funds available for direct heat projects. The Annual Imperial Valley Geothermal meeting held on June 4-5, 1981 is summarized in Appendix A. The next two power plants to come on line will be the Magma 28 MW and Southern Cal Edison 10 MW both in Salton Sea KGRA. The Geothermal Subsidence Detection Network has been resurveyed and there are now two more KGRA's in Imperial County. In April, the Geothermal Coordinator completed a study on potential Class II-1 geothermal disposal sites in Imperial Valley. This study is being reviewed at public hearings at this time. The Imperial County Geothermal Direct Heat Study is being conducted by VTN Incorporated and is one quarter complete (Appendix B).

In conclusion, with two more power plants under construction and two new KGRA's identified Imperial County, the future of the Geothermal industry is assured. The VTN Study of direct heat applications will be used to encourage additional direct heat development in Imperial County, thereby broadening development. Reduction of the Department of Energy funding for geothermal projects will have an impact on Imperial County, but will not stop Geothermal growth.

SUMMARY OF IMPERIAL VALLEY GEOTHERMAL

ANNUAL MEETING

JUNE 4-5, 1981

IMPERIAL COUNTY AIRPORT

CONFERENCE ROOM

Welcome by David E. Pierson who stated that the purpose of this meeting was to let others know what each firm is doing, both in geothermal development and research in Imperial County. Chairman, F. A. Scholz, introduced each speaker.

ROBERT LACEY - SAN DIEGO GAS AND ELECTRIC

Update on Heber Project - First commercial scale binary plant in the world - 45 MW plant. January, 1981, engineering initiated. The system will use floating cooling which is 25% more efficient. Construction due to start October, 1982; start up in 1984; and two year demonstration period in 1985.

A. M. COOPER - CHEVRON RESOURCE COMPANY

At the Heber anomaly, Chevron is the manager of the 7,400 acres that have been unitized between Chevron, Union, and NARCO. We are ready to start construction of wells for the two power plants, but awaiting final PUC certification for the Southern California Edison 45 MW dual flash power plant. We are currently renegotiating with Southern California Edison because of the denial by the PUC. This year we successfully tested a Peerless redesigned/Chevron redesigned down hole pump for 90 days (40,000 + barrels), set up a seismic network and a subsidence net.

DICK MITCHELL - COUNTY PLANNING DEPARTMENT

We are currently working on a 49 MW power plant, G overlay change, and Master EIR for the Salton Sea KGRA. The draft Master EIR will be printed next month.

Temperature wells less than 2,000 feet and 100°C use a notice of exemption from CEQA. Deep wells or power plants normally require an EIR. Planning will no longer except in-house EIR's. Funds will be provided up front to the County for a consultant and County fees. The County will then contract with the consultant. Permit fees will be rising soon.

JOHN SAKAGUCHI - VTN INCORPORATED

The Geothermal Direct Heat Study for Imperial County will prepare Imperial County for direct heat application and will be used to encourage direct heat development in Imperial County. The first phase is being done by the Ben Holt Company.

JOHN BRUGMAN - BEN HOLT COMPANY

As subcontractor to VTN, we have two tasks; the first has been completed and is a literature search of the applications suited to the Imperial Valley and agriculture, which is completed. The second, economic analysis of these processes, is being completed and should be finished at the end of this month. Several interesting processes for the Imperial Valley are sugar cane, cellulose for ethanol, and rubber production.

EDWARD ENNIS - CALIFORNIA ENERGY COMMISSION

Our funds from AB1905 are used to support direct heat projects. Currently in Imperial County, we have completed a water chemistry study, dehydration of alfalfa, possible green houses, and Master Environmental Impact Report for the Salton Sea KGRA. Questions about other projects and possible future funding of projects should be addressed to Susan Brown or myself.

ENGINEER BERNARDO DOMINQUEZ - COMISION FEDERAL de ELECTRICIDAD

Cerro Prieto has progressed through five main stages of geothermal wells development. In 1964 to 1966 the slotted liner was used which caused scaling problems. In 1966 the same casing was used with no liner. This worked well to 1500 meters but below 2500 meters cement problems were encountered and deeper, a liner was needed to insure only one stratum was encountered. In 1977-1978, a heavier gage casing (K-55) was used with great success. In late 1978 N-80 was used to increase mechanical advantage, but corrosion problems increased. Lastly, in 1980 C-75 was used for casing and liner and results are too early to tell. There have been all of the usual problems in well development and one recommendation is that after cementing a well, let set-up be at least 30 days.

We expect a well to last 10 years on line. Many of the original wells drilled in 1973 have been replaced but each for a slightly different problem. The earthquakes that have occurred in Mexico have caused no well damage but have stirred up sand which in some cases has caused problems with our equipment.

BOB ESTES - IMPERIAL COUNTY PUBLIC WORKS

The Geothermal Subsidence Detection Network damaged in the fall 1979 earthquake has been completely resurveyed. This represented 438 miles of leveling and could only be completed by the combined efforts of industry and the public sector.

On comparing this releveing to the 1978 releveing, we find that El Centro is one inch higher than before. Six miles east of El Centro, where the Imperial fault crosses Highway 86, is a 6 inch drop. At Holtville there is a half inch rise; at Keystone Road, south of Brawley was a 4 3/4 inch drop. At Brawley there was a 1 1/2 inch drop; 2 miles north of Brawley there was a 5 1/2 inch drop; Calipatria there was no change and Niland was 3/4 of an inch higher. In addition to the vertical drop mentioned, there has been horizontal movement caused by earthquakes of one or two feet.

On April 26th, Westmorland vicinity had an earthquake of 5.5 magnitude, but after checking, this area indicated no significant change.

DUTCH SCHOLZ - IMPERIAL COUNTY PUBLIC WORKS

Anticipating the need for additional geothermal hazardous wastes disposal, the County is looking for a possible site for a County 2-1 geothermal disposal site.

ELGIN MOSS - SOUTHERN CALIFORNIA EDISON

Three projects - Brawley, Salton Sea and Heber. (1) Brawley 10 MW plant went into service July 1980, has had an average capacity factor of about 50%, has achieved 10 MW gross rating, and currently disassembled for annual inspection. (2) Construction of Salton Sea 10 MW unit began February 1981 and expected to be in service July 1982. (3) Application to the PUC for a certificate of convenience and necessity for Heber 45 MW unit has been denied.

SCE has made a commitment for 70 MW of geothermal energy from Mexico for delivery in 1984 and for further MW beyond then.

OLIN WHITESCARVER - UNION GEOTHERMAL

Brawley plant was started up on June 6, 1980 and has run as anticipated.

At the Salton Sea, 4 or 5 more wells expected to be drilled later this year and start our construction at 10 MW plant at the end of summer 1981.

CHARLES BROOK - U. S. GEOLOGICAL SURVEY

USGS has classified two new KGRA's in the Valley: Westmorland and East Brawley and additions to the Salton Sea KGRA. KGRA classification is currently made regardless of land ownership and only for resources with electrical generating potential or above 150°C.

East Brawley, between Brawley and Glamis KGRA's, covers over 70,000 acres. Criteria used to define this KGRA were gravity surveys and heat flow survey. Temperatures should be in excess of 200°C at depths of 3,000 to 4,000 meters. The shallow artesian wells in the area appear to be fed from the Colorado River with little or no communication with the deep hydro-thermal system.

BILL NOWELL - PHILLIPS PETROLEUM

Phillips drilled an exploratory geothermal well in the East Brawley area last summer to 13,404 feet with encouraging initial test results and drilled two more by March 1981. Test equipment for these wells is being designed. If they are commercial, then long term plans would be electric power generation.

NORM HODGDON - MAGMA POWER COMPANY

East Mesa 10 MW power plant turbine has been rebuilt and was back on line in March and has been operating at around 6 MW since, running for 52% of March, 55% of April and 62% of May. New turbine and heat exchanger have been ordered.

The 28 MW plant at the edge of the Salton Sea is in final engineering with completion scheduled in June 1982.

One permit is left to allow a food processing plant at East Mesa.

PHIL NESEWICH - AEROJET COMPANY

The contract with Los Alamos to operate well head field test equipment simulating single and double flash power cycle operating conditions was completed in February 1981. Money was funded to Los Alamos by DOE. Objectives of the program are to provide power plant design data by identifying and characterizing scale deposition problems.

A report will be published.

CHRIS LANE - WESTEC

Westec operates the East Mesa Test Facility for the DOE. The Barber-Nicholls 500 KW direct heat exchange project and several others on the test pad are currently underway.

The well for the El Centro Field Experiment Project is scheduled for drilling in September.

The Handler's alfalfa drying feasibility study was completed recently. The economics are somewhat marginal because the current dried alfalfa market is rather poor.

KAREN WALTERS - WESTEC

The Public Utilities Regulatory Policy Act of 1978 (PURPA); it's benefits and current status were outlined. This Act provides for non utilities selling excess capacity to local utilities.

MIKE NIENBERG - WESTEC

The Master Environmental Impact Report for the Salton Sea Anomaly should be available shortly. A development scenario for 1400 MW, 29 power plants, over the next 30 years, has been developed. Subsidence, air quality, biological impacts, and water have been studied.

The biggest issue in the Valley will be water use and availability. Because of the large number of variables, it is impossible to predict the future level and salinity of the Salton Sea. The other issue will be transmission lines.

JAY SEIDMAN - TRW

The original concept at Holly Sugar was to replace practically all of the fossil fuel generated energy by geothermal.

A well has been sunk near the Imperial and Brawley faults to 10,000 feet. The bottom temperature is over 370° and the production flow is only 2 gpm artesian, stimulation has not increased the flow rate.

DOUG STOCKTON - DIVISION OF OIL AND GAS

The Division is having difficulty funding its geothermal unit. A local office may be opening in El Centro after July, headed by Dick Corbaley. Brian Sway is the new Deputy Director for the Department of Conservation.

ROWITHA GRANNELL - CALIFORNIA STATE UNIVERSITY - DEPT. OF GEOLOGY

Repetition precision gravity measurements have been taken at Cerro Prieto for about 3 1/2 years and more recently at Heber; funded by DOE. The results when combined with land leveling allow separation of mass changes from elevation changes. Good correlation was achieved at Cerro Prieto with the 1980 Victoria earthquake when changes in elevation in the order of 1 1/2 feet were predicted and took place. We are starting a survey at Heber.

JIM JACKSON - MCR

MCR have two deep wells and one shallow well at South Brawley. Tests running at equivalents of 7 MW per well resulted in brine of 283,000 ppm and scaling (iron hydroxy chloride and silica) problems with instrumentation and valves. Reinjection was no problem using charcoal filters. Further tests end of 1981 using production equipment. Power plant scheduled for 1985.

BRUCE JOHNSON - CALIFORNIA DEPARTMENT OF WATER RESOURCES

DWR are a 1.2% contributor to the Heber 10 MW binary demonstration plant and a 25% partner in the MCR South Brawley project.

Bill Hudson is our local representative in Imperial County.

DEBBI PIERCE - BATTELLE NORTHWEST

Battelle has been developing and using probes at Magma Geothermal Plant East Mesa for checking pressure, temperature, corrosion and conductivity in a program funded by DOE. The system has prevented some operation problems already. A report on this monitoring system and results at Magma should be available in October, 1981.

PABLO MACIEL - PACIFIC GAS AND ELECTRIC COMPANY

A pilot biogas plant has been running in Brawley since 1978 as a joint effort of Pacific Gas and Electric and Southern California Gas. It produced 3,000 std. cubic feet of gas from 1 ton of manure/day. This testing will end in 1981. CH₂M Hill is currently conducting a feasibility study for a commercial size plant which is anticipated by 1984. Geothermal heat may be used to maintain the digester at about 100° and for drying the residue.

WARREN MCBEE - SPERRY RESEARCH PROJECT

The DOE funded pump test will start the end of June and run 4 months. With brine at 350°F, flow rate of 1000 gpm, and pump at 1700 feet the system is designed to be 36% more efficient than a conventional binary process. After the down hole pump test, the down hole heat exchanger and well head generator will be tested and on line by 1982, if funding arrangements are completed.

We now recommend welding casing rather than threaded casing.

WILLIAM F. MORRIS - LAWRENCE LIVERMORE LABORATORY

We have done chemical extraction test (EPA Toxicity Tests) on a limit quantity of geothermal wastes. No new discoveries, except that brines and scales may have high barium and lead, but very little extraction.

The feasibility of using agricultural drainage water for geothermal power plant cooling has also been looked at.

DR. FRANK E. ROBINSON - UNIVERSITY OF CALIFORNIA, IMPERIAL COUNTY
AGRICULTURAL EXTENSION

The East Mesa field station used Republic's geothermal water in irrigation tests. This water has 2200 ppm TDS $\pm$ 1200 vs. groundwater at 1400 ppm. promising results have been obtained with tamarisk, palm tree and sugar beet.

For comparison the TDS of other water are, Colorado River 880 ppm, triple A drinking water 350 ppm, sea water 36,000 ppm, Salton Sea water 39,000 ppm.

RALPH DiCORI - IT. CORPORATION

Operations started on December 18, 1980 at the site, 5 miles west of Westmorland. 350 of the 640 acre site are developable as a hazardous waste site. Solar evaporation, land treatment and subsurface injection are being used. Less than 30 acres of the site have been developed so far.

OBSERVER'S COMMENTS

Tom Heenan, DOE - Development is moving from R. and D.

Concerns now are real world (i.e. solid waste). A good down hole pump is a step forward. As is several geothermal power plants on line. Yet some R & D is still needed like the Sperry Project.

Another concern is Direct Heat Development. Direct heat applications do not have the resources to drill wells. This problem must be resolved.

EDWARD J. ENNIS - CALIFORNIA ENERGY COMMISSION

Good meeting. People dealing with real problems. Recommend next year presentaters leave view graphs for inclusion in summary.

ATTENDEES
IMPERIAL VALLEY GEOTHERMAL DEVELOPERS MEETING
June 4 & 5, 1981

<u>REPRESENTING</u>	<u>NAME</u>	<u>ADDRESS & PHONE NUMBER</u>
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UNIVERSITY OF ARIZONA	Dr. Don H. White Geothermal Team Leader	2045 N. Forbes Blvd, Suite 106 Tucson, AZ 85705 (602) 626-1225
	Larry Goldstone Project Manager	2045 N. Forbes Blvd, Suite 106 Tucson, AZ 85705 (602) 626-4391
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Engineers • Architects • Planners

July 1, 1981

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IMPERIAL COUNTY
DEPT. OF PUBLIC WORKS

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Mr. David E. Pierson
Director of Public Works
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El Centro, California 92243

Subject: Quarterly Progress Report for the Period Ending June 30, 1981
Geothermal Heat Application Study

Dear Mr. Pierson:

The following summarizes the work which has been completed through June 30, 1981, on the Direct Geothermal Heat Application Study.

Introduction

The VTN/Ben Holt team initiated work on the study in the latter part of January, 1981. The work on Tasks 1 and 2 has been essentially completed. The effort on Task 3 has been initiated. Task 4 will not be initiated until completion of a preliminary review from the County on the findings of Tasks 1 and 2.

Tasks Completed

1. Interim Report for Tasks 1 and 2.

A draft report for Tasks 1 and 2 has been completed. The report followed the revised outline which was discussed on February 17, 1981. The interim report was based upon the work tasks which were set forth in the proposal submitted to the County in August, 1980. The tasks primarily involved a literature search, analysis of the data, and extensive contacts and interviews with firms specifically involved in geothermal activities which may be applicable to Imperial County.

In order to determine the heat applications which may be most applicable to Imperial County, an extensive literature search and review was conducted. This effort involved an analysis of research which had been previously conducted on geothermal heat applications. The findings

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indicate that almost any process or activity which requires thermal energy below 400°F can be adapted to geothermal resources available in Imperial County. Thus, any of the applications identified in this study potentially may be initiated and developed at any of the major resource areas located in the Imperial Valley. However, since the effort of this task was to determine geothermal heat applications most applicable to Imperial County, the research was conducted in five major areas. These major areas reflect the County's major economic activity, which is agriculture. The five major areas of study included: (1) agriculture; (2) aquaculture; (3) food processing; (4) ethanol production, and (5) industrial/manufacturing.

The primary agriculture uses which potentially could involve geothermal heat applications are: greenhouses, crop cooling and packing, dehydrating alfalfa, and feedlot operations. Aquaculture uses include the Malaysian prawn and catfish farming. Food processing applications which were examined included vegetable dehydration, freezing applications, and vegetable canning. Ethanol production was reviewed primarily from the point of view of converting carbohydrates to ethanol. Industrial and manufacturing uses included mineral recovery and fertilizer manufacturing.

In addition to these concepts, a series of new or innovative concepts were analyzed. These included a number of uses proposed for geothermal energy which have not been investigated thoroughly or require knowledge not currently available. The uses were not examined in detail, however, because of the potential for use in Imperial County they were briefly examined. These concepts included developing an industrial park based on primarily geothermal uses, the use of low-level heat from power plant operations, production of ethanol from cane sugar, or cellulose, and the use of heat in processing of the guayule rubber plant.

There appear to be several major constraints to development of direct use applications in the Imperial Valley. These were primarily identified during the interview process and indicate some of the areas in which the County and/or developers must act in order to provide the basis for direct heat applications to occur in Imperial Valley. One of the primary constraints to development of direct use geothermal applications in Imperial Valley appears to be the lack of an economical way for a user to obtain geothermal heat. Most direct use applications identified in the study would not support the development of a single geothermal well. The scale of the projects identified in this study almost preclude investment in development of a well dedicated to the particular use. In addition to this problem, there is no established

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pricing procedure in the County for geothermal heat. Prior to attracting direct use developers, the potential user must have some general indication of the price of energy in order to undertake even a preliminary feasibility analysis.

The lack of proven technology and operating history for any major scale geothermal development using hot water in the United States also appears to be a major concern to potential direct use developers. Potentially, the construction and operation of geothermal power plants could alleviate some of this concern. Clearly, any successful major development of geothermal resources would provide a basis for generating interest in direct use applications in the United States.

During the interview process, most of the users stressed the need to have a clear, basic understanding and knowledge of a particular business prior to undertaking the use of geothermal energy. For example, the basic business of crop cooling must clearly be understood before a user should attempt to undertake development of a project utilizing geothermal energy. The geothermal aspect of the project provides an innovative concept which can be used to advantage. However, by itself it will not make a particular business attractive. A basic understanding of the investment criteria, operating procedures, and marketing requirements of the particular business segment must also be understood.

Based on these findings, it would appear as if development of direct use geothermal applications would most likely be successful among firms who are already operating in a particular business segment. It would be difficult for a geothermal developer to successfully develop a crop cooling business without a clear understanding of that particular business.

Tasks to be Completed

1. Task 3

A preliminary outline of Task 3 has been developed and is attached. The effort in Task 3 would be to briefly describe the projected socio-economic benefits/impacts in Imperial Valley which may result from direct heat development. To accomplish this task, the analysis will include a brief review of the existing conditions in the Valley relative to employment, population, schools, public facilities, community services, and tax base characteristics. The projected effects on each of these areas from each direct use application will be analyzed in the Task 3 report.

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2. Task 4

Task 4 involves identification of potential geothermal direct use developers interested in Imperial Valley. This task will involve research through the Dun and Bradstreet Market Identifier records. The task will be initiated upon completion of preliminary review of the Tasks 1 and 2 Interim Report.

Very truly yours,

VTM CONSOLIDATED, INC.

John L. Sakaguchi
Project Manager

JLS/glw

cc: F. A. Scholz
J. Brugman, The Ben Holt Co.

GEOHERMAL HEAT APPLICATION STUDY - PRELIMINARY OUTLINE

Task 3: Review of Projected Socioeconomic Benefits/Impacts

4.0 Projected Socioeconomic Benefits/Impacts

4.1 Existing Conditions

- 4.1.1 Employment
- 4.1.2 Population
- 4.1.3 Schools
- 4.1.4 Public Facilities
- 4.1.5 Community Services
- 4.1.6 Tax Base Characteristics

4.2 Projected Effects*

- 4.2.1 Employment
- 4.2.2 Population
- 4.2.3 Schools
- 4.2.4 Public Facilities
- 4.2.5 Community Services
- 4.2.6 Tax Base

* This section will include an analysis for each type of potential use identified in Task 1.

Task 4: Identification of Potential Geothermal Direct Use Developers
Interested in Imperial Valley

The result of Task 4 will be a set of index cards, a computer listing of company names and mailing labels. An outline of this task is not appropriate.