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MASTER

DIRECT UTILIZATION OF GEOTHERMAL
HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS
AT NAVARRO COLLEGE

Annual Report
for the Period
January 1980 - December 1980

Prepared by
Kenan Smith - Director
Environmental Aquaculture Services

Work Performed Under Contract

DE-FC08-79ET27508
DE-FC08-79ET27058

NAVARRO COLLEGE
Corsicana, Texas

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U.S. Department of Energy
CONTRACT MANAGEMENT ANNUAL PROJECT REPORT

1980

TITLE: DIRECT UTILIZATION OF GEOTHERMAL HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS, AT NAVARRO COLLEGE

AGREEMENT:

Number: DE-FC08-79ET27058
Start Date: March 1, 1979
Completion Date: September 30, 1984
Participant: Navarro College
Highway 31 West
P.O. Box 1170
Corsicana, Texas 75110

1980

JANUARY

Work continued on obtaining estimates to test the production zone at 3900 feet and to determine if this zone would supply the quantity and quality of geothermal fluids needed for space heat applications.

FEBRUARY

Tentative agreement had been received from DOE to perforate well #2 at the 3900 foot production zone and perform an abbreviated pump test on formation fluids.

MARCH - APRIL

The #2 well zone was shot perforated on March 4, 1980, in the 3900 foot production zone. A flow of less than 20 GPM from a depth of 800 feet was established. Temperature of the fluid was 158° F and had a total Dissolved Solids Content of 24,000 PPM consisting mainly of sodium chloride.

Results of the water quality analysis were studied to determine if this reservoir was acceptable for the proposed space heating application.

MAY

Due to the poor quality and quantity of water available from the #2 well, an investigation into possible surface disposal of fluids from the Woodbine Formation was investigated.

JUNE

Nothing new in the developments this month, developments about the same as the month of May, 1980. Limited Funding.

JULY

Further development and testing of well #1 and #2 could not be performed until additional funding was granted by DOE.

Continued investigation of surface disposal of the Woodbine Fluids was studied.

AUGUST - SEPTEMBER

Funding had been approved by DOE to further develop and test wells #1 and #2. Low levels of Alpha and Beta activity in the woodbine waters were discovered. Plans were developed to plug the Glen Rose (3900 foot) Formation back to the lower Woodbine Formation for further testing.

OCTOBER

On October 30, 1980, the Glen Rose Formation at 3900 feet in well #2 was plugged back to the lower Woodbine Formation at 2600 feet and perforated. Both wells were then cleaned up and prepared for pump tests.

NOVEMBER

An electrical submersible pump was installed in well #1 for testing purposes. Once work was completed concerning supply of proper electrical power, testing efforts would be continued.

DECEMBER

The production well #1 was tested during the period of December 17th thru December 22, 1980. Water levels in both wells were monitored during the test and when well #1 was pumped, an immediate drawdown was noted in well #2. Due to this interference and communication between wells, a plan was developed to plug back well #2 for further use as the injection well. These results were analyzed for appropriate actions and recommendations.

For more explicit details and information see monthly and special reports submitted to the United States Department of Energy, Nevada Operations.

Dr. Lary Reed, Project Director
Navarro College
Kenan C. Smith, Project Coordinator
Navarro College

the No. 2 well is perforated and pump tested.

Task 4.	<u>Preliminary Design Report</u>	Uninitiated
Task 5.	<u>Final Design Report</u>	Uninitiated
Task 6.	<u>Economic Analysis</u>	Uninitiated
Task 7.	<u>College/Hospital Heating System</u> - Work is continuing on the preliminary design of the heating system, but at a somewhat reduced pace due to the delay in drilling the well and the uncertainties concerning the fluid production temperature and well flow rate. Efforts on the energy conservation analysis are continuing.	
Task 8.	<u>Fluid Distribution System</u> - Efforts are underway in the preliminary design of the geothermal fluid distribution and utilization system but detailed work will be delayed until the temperature and flow capacity of the well is identified.	
Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

It is planned that the well will be tested for water production at the formation depth in question (about 3900 feet) following a more detailed review of the logs. If it appears that temperature and well capacity meet the anticipated requirements of the building heating loads, this formation will be produced during the pump test. If, however, more production is required it may be feasible to perforate the Woodbine as well and pump test both formations. In any case, the delays in drilling the No. 2 well and subsequent delays due to review of the logs and consultation with well testing contractors may push back the preparation and submittal of the preliminary design report by about two months from the work schedule dated 26 November 1979. A more detailed

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look at the schedule will be performed during the next reporting period and a revised schedule may be required for submittal at that time. Completion of material testing using actual production fluid on-site is also delayed until the production well is completed and the production pump is in place.

4.0 VARIANCE/PROBLEMS

4.1 Cost Variances - A positive current and cumulative variance is shown in the revised Contract Management Survey Report. These variances are primarily due to delays in invoicing of services and well materials.

4.2 Schedule Variances - Other than a possible 2 month shift in the schedule as indicated in Item 3.0 above, no variance is expected at this time.

5.0 OPEN ITEMS

The No. 2 well has yet to be perforated and pump tested. On-site materials testing has yet to be performed.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Copies of the logs taken during December have been sent to DOE and other interested parties for review. Once this review is accomplished the best candidate formation(s) will be perforated and production testing of the well will be performed. Efforts are now underway to obtain cost estimates from well testing contractors to perform such testing work. Once the fluid temperature and well capacity is determined, efforts on the preliminary design and other fluid dependent work areas can continue.

C. P. Green, Director
Navarro College

cc: Morris Skalka
S.M. Hansen
Judith A. Florance

4.0 VARIANCE/PROBLEMS

4.1 Cost Variances - A positive current and cumulative variance is shown in the Contract Management Summary Report. These variances continue to be primarily due to delays in invoicing of services and well materials, rather than under-expenditures for these items. Total project expenditures are expected to be very close to the cumulative budgeted costs for FFY 1979 and 1980. Some activities such as a full production test of Well No. 2 may have to be delayed until FFY 1981.

4.2 Schedule Variances - The completion of the Preliminary Design is expected to be delayed 2-3 months due to uncertainties concerning the production fluid.

5.0 OPEN ITEMS

The zone of interest at 3900 feet has yet to be perforated for evaluation of the fluid and the static level. A full pump test has yet to be performed depending on the results of a preliminary formation test using a small pump downhole. On-site materials testing may not be performed due to limitations with the FFY 1980 project budget and problems with scheduling equipment and personnel to perform tests in the near future. Preliminary materials selection for system design can be made, however, using corrosion and scaling experiences for similar composition fluids.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Plans are underway to go ahead and perforate the formation of interest, perform a preliminary pump test of the formation, and obtain a fluid sample for analysis. The most cost effective methods for performing this work, in order to stay within program budget, are being investigated.

C. P. Green, Director
Navarro College

cc: Morris Skalka
S.M. Hansen
Judith A. Florance

material for the originally proposed No. 2 Woodbine well is sold and the credit received returned to the project budget.

- 4.2 Schedule Variances - The completion of the Preliminary Design is continuing to be delayed due to uncertainties concerning which fluid and from which well the fluid will be produced. This work is expected to be delayed by around 3 months after the date on which the fluid and well to be used for production is determined. This will necessarily shift the work schedule indicated in the attached Contract Management Summary Report and the 26 November 1979 Work Schedule.

5.0 OPEN ITEMS

The determination on which well to be used for production has yet to be made pending perforation of Well No. 2 at 3900', and analysis of potential scaling and corrosion problems due to the resultant fluid composition. A full pump test is expected to be delayed until FFY 1981 due to budget constraints. On-site electro-chemical tests of candidate system materials will not be performed, but preliminary materials selection can be made using corrosion and scaling experiences for similar composition fluids.

6.0 RECENT AND PLANNED ACHIEVEMENTS

During the next reporting period, the No. 2 Well will be perforated and an abbreviated pump test performed to obtain formation fluid samples.

C. P. Green, Director
Navarro College

cc: Roland Marchand
Eric Peterson
S.M. Hansen
Judith A. Florance

6.0

RECENT AND PLANNED ACHIEVEMENTS

Efforts are continuing for investigation of problems evident using Well No. 2 fluid. Tentative preliminary design efforts using Well No. 1 fluid are underway.

A handwritten signature in cursive script, appearing to read "C. P. Green", written over a horizontal line.

C. P. Green, Director
Navarro College

- 4.2 Schedule Variances - The completion of the detailed Preliminary Design is continuing to be delayed until further investigations are made concerning surface disposal of Woodbine fluid and development and testing work on Wells No. 1 and No. 2. This work is expected to be delayed until the end of this fiscal year (September 1980). This shift of work schedule is indicated in the attached Contract Management Summary Report.

5.0 OPEN ITEMS

On-site electrochemical tests of candidate system materials will not be performed, but preliminary materials selection can be made using corrosion and scaling experiences for similar composition fluids. Further development and testing work on Wells No. 1 and No. 2 will not be performed until additional funds are received for this work.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Preliminary investigation of the surface disposal of Woodbine fluid is underway.

C. P. Green, Director
Navarro College

cc: Eric Peterson
S.M. Hansen
Judith A. Florance
Roland Marchand

14 July 1980

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can be made using corrosion and scaling experiences for similar composition fluids. Further development and testing work on Wells No. 1 and No. 2 will not be performed until additional funds are received for this work.

6.0

RECENT AND PLANNED ACHIEVEMENTS

Preliminary investigation of the surface disposal of Woodbine fluid is in progress.

C. P. Green, Director
Navarro College

Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCE/PROBLEMS

None

5.0 OPEN ITEMS

5.1 Preliminary materials selection will be made using corrosion and scaling experiences for similar composition fluids.

5.2 Further development and testing work on Wells No. 1 and No. 2 can not be performed until additional funds requested are received for this work.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Investigation of the surface disposal of Woodbine fluid is continuing. A site visit was made by Radian to investigate the candidate disposal routes.

C. P. Green, Director
Navarro College

cc: Eric Peterson
Roland Marchand
S.M. Hansen
Judith Florance

18 September 1980

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Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCE/PROBLEMS

A revised project schedule is attached.

5.0 OPEN ITEMS

- 5.1 Preliminary materials selection will be made using corrosion and scaling experiences for similar composition fluids.
- 5.2 Further development and testing work on Wells No. 1 and No. 2 will be performed in the near future.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Recent analyses of Woodbine fluid taken from Well No. 1 last year indicate some alpha and beta particle activity in the water, which would probably preclude use of this fluid for livestock watering purposes. Further decisions on whether surface disposal of this fluid is appropriate will be made after additional analyses of water samples (to be taken during the planned well development operation) are performed for confirmation. Planning is under way for scheduling the plugging of the Glen Rose perforations in Well No. 2, perforating Wells No. 1 and No. 2 additionally in the Woodbine Formation, and further development and production/injection testing of the wells.

C. P. Green, Director
Navarro College

Task 9.	<u>O & M Manual</u>	Uninitiated
Task 10.	<u>Public Awareness Program</u>	Initiated
Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCE/PROBLEMS - None

5.0 OPEN ITEMS

- 5.1 Preliminary materials selection will be made using corrosion and scaling experiences for similar composition fluids.
- 5.2 Further development and testing work on Wells No. 1 and No. 2 will be performed in the near future.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Plans for further development and testing of Wells No. 1 and No. 2 are underway.

C. P. Green, Director
Navarro College

Task 9. <u>O & M Manual</u>	Uninitiated
Task 10. <u>Public Awareness Program</u>	Initiated
Task 11. <u>Institutional Factors</u>	Initiated
Task 12. <u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCE/PROBLEMS - None

5.0 OPEN ITEMS

- 5.1 Completion of preliminary design activities is awaiting results of additional development and testing work on Wells No. 1 (production) and No. 2 (injection).
- 5.2 Further development and testing work on Wells No. 1 and No. 2 will be completed in the near future.

6.0 RECENT AND PLANNED ACHIEVEMENTS

On October 30, 1980, the Glen Rose formation at 3900 feet was plugged in Well No. 2. The Woodbine formation at 2600 feet was perforated in Well No. 2 and additional perforations were made in that formation in Well No. 1. Both wells were swabbed to clean up the new perforations. Efforts are underway to perform a pump test of Well No. 1 to evaluate results of this additional development.

C. P. Green, Director
Navarro College

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCE/PROBLEMS - None

5.0 OPEN ITEMS

5.1 Completion of preliminary design activities is awaiting results of additional development and testing work on Wells No. 1 (production) and No. 2 (injection).

5.2 Further testing work on Wells No. 1 and No. 2 is anticipated to be completed in the near future.

6.0 RECENT AND PLANNED ACHIEVEMENTS

An electric submersible pump has been installed in Well No. 1 for testing purposes. Once work is completed concerning supply of a proper electrical power, testing efforts will be continued.

C. P. Green, Director
Navarro College