GL009558

New Mexico Research and Development Institute

DIRECTOR
Larry Icerman

June 7, 1988

Mr. Kenneth Taylor
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

RE: Grant No. DE-FG07-84ID12546

Dear Mr. Taylor:

Please find enclosed eight (8) copies of the Final Technical Report for the above Grant. I hope you find the report both informative and professionally prepared. The camera-ready original will be forwarded under separate cover.

If you have any questions regarding the report, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:jg

cc: File DE-FG07-84ID12546

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

February 9, 1988

Dr. Larry Icerman
Director
New Mexico Research and Development Institute
Pinon Building, Suite 358
1220 South St. Francis Drive
Santa Fe, NM 87501

Dear Larry:

I have just completed my review of the NMRDI draft final technical report, "New Mexico Statewide Geothermal Energy Program". Perhaps the most enjoyable part of my work on the State Cooperative Program is the review of technical reports completed by the state teams. This has been especially true for your report because of the quality and variety of the technical work, and because of my own past familarity with southwestern New Mexico. I especially enjoyed reading the Geothermal System Models and Concluding Remarks for Chapter 1.

The report is generally in excellent shape and represents a fine contribution to the geothermal resource data base of New Mexico. I have noted a few problems with references, figures, etc. (very few considering the extent of the report) and these are noted in the accompanying comments. Please address these comments before the final report is submitted to DOE.

I think that the concluding sections of Chapters 3 and 4 could be strengthened with a summary discussion of the geologic models for the resource areas and of the geothermal potential of the areas. The discussion need not be lengthy but should bring out the new resource information generated by the study.

Please call me at (801) 524-3444 to discuss any of my comments. Thanks once again for the opportunity to review this interesting report.

Sincerely,

Howard Ross

Howard P. Ross
Project Manager, SCP

encl
cc: Ken Taylor

REVIEW COMMENTS

"NEW MEXICO STATEWIDE GEOTHERMAL ENERGY PROGRAM"

Chapter One

Page	Item
1-16	Fig. 1-6. Reference point referred to on pg.1-15 (Truth or Consequences) is not shown on map.
1-29	Fig. 1-9. QZ volcanism is not in the legend. Should it be QE on the map? It is hard to read AN on the map; it's hard to read the _mi and _km on the bar scale.
1-31	Fig. 1-10. Cannot distinguish between aquifer units 1,2,3 and Aquitard Unit A,B. Symbol for Unit B is not clear. A good illustration but some confusion in unit identification.
1-32	1.3.2 Aquitards-Unit A: do the fine grained facies even approach 1,000 m in thickness? If not a more restrictive figure would be more meaningful. Unit B- same comment. It's hard to believe that all 1,000 m would be fine grained and an aquitard.
1-35, 1-36	Fig.1-11,-12. The small scale and lack of geographic reference points (i.e. cities, towns) makes it hard to relate specific areas to contoured features on the maps. Would it be possible to add reference points without cluttering up the data, or to include a transparent overlay with geographic features?
1-36	Fig. 1-12. Pattern for areas >500 ft. deep is faded out in several parts of the map on my print.
1-37	Para. 2. Reference to Las Cruces, but can't locate on maps.
1-38	Para. 2. Can't locate geothermal systems mentioned in text (T or C, GHS, RS, LFHS) on maps of Fig. 1-11,-12.
1-44	Fig. 1-14. It's hard to read the smallest print on figure- letters run together for names of several wells and springs, i.e. Windmill, Morgan Springs(?), Running Indian Well, etc.
1-45	Table 1-2. Column headings should be Temperature Gradient (°C/km) rather than temperature.
1-46	Para. 2. Suggested wording change to reduce confusion: Domain 1 shows a heat flow distribution generally between 50 and 60 . . rather than a dominant heat flow distribution . .
1-50	Para 1. Sierra de Las Uvas referred to in text is not located on Fig. 1-11 or Fig. 1-17.

1-54. Fig. 1-20. Excellent summary figure!

Missing or incorrect references.

1-16. Cather and Johnson (1984), Feller (1975); not in refs (n.i.r)

1-17. Seager (1986) n.i.r.

1-20. Wahl (1987) n.i.r.

1-25. Drewes et al. (1975) n.i.r.

1-29. Scarborough (1985) n.i.r.

1-41. Lohse et al (1981a), (1981b) n.i.r.
Morgan et al (1980), Roy et al (1968b) n.i.r.

1-45. USGS Watstore Files (1975,1986) n.i.r.

1-56. Bikerman, M.- American Abstract (typo)

1-58. Condie, K.C., 1982- continual accreation or continental ?

Chapter 2 Straightforward and well written; I did not note any specific problems with figures, typos, etc.

Chapter 3.

3-7, 3-8. The discussion of the thermal data would be greatly enhanced by a figure showing the shallow, warm groundwater plume (possibly contoured?) and the location of deep, higher temperature wells, controlling geologic structures, etc.

3-9. There is no technical discussion or interpretation of the data of Table 3-4 which show considerable variation and interesting values.

3-19 to 3-22. It would be nice to have a figure integrating the shallow and deep temperature information, geologic structures, fluid concentration gradients, etc. And a brief summary interpretation and discussion of the geologic model of the resevoir in view of all the data available to date.

3-23. Hawkins, D.B.- in Icerman, L. (typo)

3-24. Appendix A title page. It would be nice to include an explanation about the data source, i.e." Temperature measurements by AMAX Exploration, 1975-1976" or the name of the contractor, if any.

Chapter 4

Page Item

4-16, line 2. zone (not zoned)

4-15, 4-16. The disturbed temperature gradient due to fluid entry (?) for short depth intervals, 290-295 m and 305-317 is recognized by the authors. It probably isn't meaningful to use this disturbed gradient to compute and report a heat flow value, without noting this shortcomming in the text.

4-16, 4-17. There is no significant discussion of the geothermometry. Our geochemists tell me that the adiabatic quartz geothermometer has little significance if the fluid has not boiled. The Na/K geothermometer could be way off with these high Ca, Mg values. If the values are presented these limitations should be discussed.

4-18. There is no geologic discussion or interpretation of the water quality data.

4-24. The discussion of ground water levels and slopes would be enhanced by a schematic map or section showing water table depths.

4-28. Para.2 Is the discussion relative to the position of the Jarilla Fault Zone and the gravity low correct? The main gravity low generally occurs over the center or deepest portions of alluvial filled basins, with the steepest gradients near or close to the basin bounding faults. My 1:500,000 scale gravity map shows the minimum gravity values some distance west of the estimated position of the J F Z.

4-28. Para 3. Which data from the drilling operations show that the J F Z is located west of the well- depth to bedrock?

4-29. Cannot read the elevation scale for these sections.

4-30. Line 2. What is the 6300 feet of displacement based on?

4-31. Concluding remarks - nothing is said about a preliminary geologic model for geothermal resources, what has been learned about reource potential, and the source of thermal fluids. Can't this be summarized here?

Missing or incomplete references.

4-14. Decker, 1975 (missing in refs) or Decker & Smithson?

4-27,-30. King, 1982 (missing ref) or King & Harder?

New Mexico Research and Development Institute

DIRECTOR
Larry Icerman

January 29, 1988

Mr. Kenneth Taylor
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Re: Grant No. DE-FG07-84ID12546 Draft Final Technical Report

Dear Mr. Taylor:

Please find enclosed one (1) copy of the draft final technical report for Grant No. DE-FG07-84ID12546. I trust you will be pleased with the results of the work and the quality of the report.

If you have any questions on this draft, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:asl

cc: File DE-FG07-84ID12546

FEB 1 1988

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

New Mexico Research and Development Institute

DIRECTOR
Larry Icerman

December 15, 1987

Ms. Susan Prestwich
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

Re: Grant No. DE-FG07-84ID12546, No-Cost Extension Request

Dear Ms. Prestwich:

I am writing to request a no-cost extension on the above Grant from December 31, 1987, to February 29, 1988. All of the field and analysis work conducted under the three subcontracts supported under this Grant has been completed, along with the draft reports. Unfortunately, some minor delays have been encountered in integrating these three draft reports into a comprehensive, professionally prepared final technical report. This request is being made in order for final editing and/or incorporation of comments or suggestions by DOE-selected reviewers to qualify for reimbursement.

The current estimated schedule is to have a very polished draft completed by mid-January 1988. I have spoken with Howard Ross about the minor delays and the projected completion schedule. He suggested that I should consider making a no-cost extension request. Upon reviewing the situation, I believe his advice is sound.

I hope you will give favorable consideration to this request. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

cc: File DE-FG07-84ID12546
Howard Ross, URRI

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

Rec 11/09/87

U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

FORM DA-... | FORM APPR... OMB No. ...

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FG07-84ID12546	New Mexico Geothermal Energy Project	7-1-87 through 9-30-87
4. Name and Address	New Mexico Research and Development Institute 1220 S. St. Francis Dr. Pinon Bldg. Suite 358 Santa Fe, New Mexico 87501	5. Program/Project Start Date: 9/7/84 6. Completion Date: 12/31/87

7. Approach Changes

☐ None

8. Performance Variances, Accomplishments, or Problems.

* The subcontract with New Mexico State University to complete mapping of the geothermal resourc in south-central New Mexico is proceeding satisfactorily. The heat-flow map, heat-flow/gradie hole location map, and temperature gradient map are now all complete. A draft final report for this subcontract is currently under review.
* A third programming plan was approved by DOE on August 12, 1987, as the result of previously planned work being interupted by litigation concerning access to lands in the Animas Valley. The new work involves preliminary geothermal reservoir assessment in the Orogrande, New Mexico area located in the Tularosa Basin. This work is being performed by Lightning Dock Geothermal under a modified subcontract with NMRDI effective July 1, 1987. Most of the scheduled field work has been completed. Preliminary data evaluations and interpretations have been prepared. A draft report will be completed early in the coming quarter.

☐ None

9. Open Items

☐ None

10. Status Assessment and Forecast

☐ No Deviation from Plan is Expected

11. Description of Attachments

☐ None

12. Signature of Recipient and Date

[signature] 10/7/87

13. Signature of DOE Reviewing Representative and Date

FORM EIA-459E (10/83)

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE MANAGEMENT SUMMARY REPORT

FORM APPROV. OMB No. 1900-

Page ___ of ___

1. Program/Project Identification No. DE-FG07-84ID12546	2. Program/Project Title New Mexico Statewide Geothermal Energy Program	3. Reporting Period 7-1-87 through 9-30-87
4. Name and Address New Mexico Research and Development Institute, 1220 S. St. Francis Drive, Pinon Bldg, Suite 358, Santa Fe, New Mexico 87501		5. Program/Project Start Date 9-7-84
		6. Completion Date 12-31-87

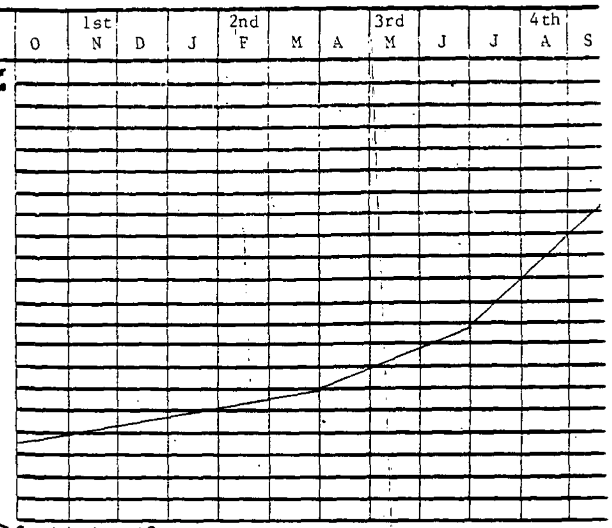
7. FY 87 8. Months or Quarters: 4th Quarter

9. Cost Status a. Dollars Expressed in: Thousands b. Dollar Scale

10. Cost Chart

Fund Source		Quarter 1st	2nd	3rd	4th	Cum. to Date	Tot. Plan
DOE	P						
	A	4.3	5.2	15.9	27.0	76.0	
	P						
	A						
	P						
	A						
	P						
	A						
Total P							
Total A							
Variance							

P = Planned A = Actual



Total Planned Costs for Program/Project		O	N	D	J	F	M	A	M	J	J	A	S
	Planned		4.3			5.2			15.9			27.0	
	Actual												
	Variance												

11. Major Milestone Status (Units Planned / Units Complete)

Milestone	P/C	Status
1.1 Develop RFP's	P / C	
1.2 Issue RFP's	P / C	
1.3 Review RFP's	P / C	
1.4 Select Awardees	P / C	
1.5 Negotiate Contract	P / C	
2.0 NMSU Geothermal Work	P / C	
2.1 Prepare Invitation for Bids	P / C	
2.2 Refine Well Plan with	P / C	
Selected Driller	P / C	
2.3 Deepen Well	P / C	
2.4 Well Logging and Testing	P / C	
2.5 Analyze and Interpret Well	P / C	
Data	P / C	
3.0 Resource Mapping	P / C	▲ (A)
4.0 Reservoir Hydrology	P / C	△ (S)
	P / C	
	P / C	

12. Remarks

13. Signature of Recipient and Date: [signature] 10/1/87

14. Signature of DOE Reviewing Representative and Date

New Mexico Energy Research and Development Institute

October 23, 1985

DIRECTOR
Larry Icerman

Mr. Duncan Foley
University of Utah Research Institute
Earth Science Laboratory
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108

Dear Mr. Foley:

Thank you for reviewing the proposal entitled, "Geothermal Downhole Heat Exchange Stimulation." The Director accepted the recommendation of the Technical Advisory Committee that the proposal should not be funded.

Your review was very helpful to the Director and the Committee in reaching this decision. We very much appreciate the time and effort that you spent in developing your evaluation.

Sincerely,

R. Rea

Robert H. Rea
Assistant Director
Project Development

U-211

Room 358, Piñon Building, 1220 S. St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

JUSTIFICATION FOR NON-COMPETITIVE AWARDS

I recommend that negotiations be conducted only with those organizations listed below for the services described herein in accordance with DOE-PR 9-3.805-501.

Organization

State of Washington, Department of Natural Resources
State of Washington, Energy Office
State of Oregon, Dept. of Geology & Mineral Industries
State of Oregon, Department of Energy
State of Alaska, Department of Commerce & Economic Development, Office of Energy
University of Alaska, Geophysical Institute
State of Alaska, Department of Natural Resources
New Mexico State University, Energy Institute
State of New Mexico Energy & Minerals Department
Idaho Department of Water Resources
State of Utah, Utah Geological & Mineral Survey
State of Utah, Division of Water Rights
State of Montana, Dept. of Natural Resources & Conservation
State of Montana, College of Mineral Science & Technology

1. Description of Supplies or Services to be Supported

A. The actions with the above named universities and state government agencies are for geothermal resource assessment and to promote geothermal technology transfer within the participating states. Emphasis will be placed on detailed studies within areas with high temperature resources and/or expansion of work previously conducted within the states.

B. The work to be provided by each university or state agency will be tailored to the needs within each state and DOE objectives for continued resource assessment and technology transfer.

2. History, Estimated Future Requirements, and Long-Range Objectives

A. The State Teams Programs were initiated approximately seven years ago. At the program peak DOE-ID was administering 39 geothermal contracts, cooperative agreements, or grants with universities and state agencies. Eight of the above mentioned organizations are at present in the final phases of their agreements with DOE; the remainder have completed the work, and their agreements were closed out.

B. This work is a continuation of the previous program in the sense that it is for geothermal resource assessment and technology transfer. However, the new emphasis will be in accordance with the generic guidelines set forth in C below and will investigate higher temperature systems.

C. All work will be within the generic guidelines of DOE which are to implement these activities within states which:

1. Have potential for high temperature geothermal resources
2. Whose resource assessment efforts will support R&D investigations required by magma and Cascades research programs
3. Have existing resource and energy groups actively supporting geothermal development
4. Are currently providing outstanding technology transfer and institutional problem mitigation activities

D. It is not anticipated that DOE will be able to develop competition for this work. The performing state agencies and universities were designated by the Governor's Office of each participating state. An attempt to stimulate competition would be contrary to DOE's policy of cooperation with state governments.

3. Estimated Cost

A. The program funding level of $1,925,000 was designated by the FY-84 Appropriations Bill and DOE-HQ. The funding levels for the individual states range from $ 90,000 to $145,000 and were established by ID and HQ based on the prior state teams annual funding levels, the amount and quality of work previously accomplished at these levels, and the amount of productive work remaining to be done.

B. The FY-84 funding level for the portion of the program to be administered at DOE-ID is $1,295,000 of the total program funding of $1,925,000. This level of funding is lower than any of the previous seven years; the amount to be funded in future years is uncertain.

C. It is the intent of this program to expand the knowledge of higher temperature resources within individual states. This work was performed in previous years by the organizations within each state which were designated by the respective Governor's Office. Any change in contractors at this time would increase costs and delay the program and could only be undertaken with the consent of the Governor's Office in each state.

4. Schedule Requirements

A. The basis for the rapid emplacement of the subject program is the imminent close-out of the agreements DOE now has with several of the organizations we wish to have perform under the FY-84 program. The agreements presently in place are scheduled for various completion dates ranging from almost immediately to September 1984.

B. It is important to get the work started as soon as possible because the existing expertise may be disbanded if the work presently contracted for is completed prior to the emplacement of this subject program. The existing expertise has been developed to a great extent under the previous DOE-ID contracts and a lapse in DOE funding could result in lack of financial support for the organizations. This cadre of experienced expertise is critical for high quality resource assessment and technology transfer, and it is doubtful that any other organizations can perform as well in the respective states as those which are listed above. Rapid emplacement of this program will help ensure the retention of the existing expertise.

C. It is doubtful that any savings can be realized or that competition can be increased by relaxing schedules.

5. Exclusive Capacity & Capability

It was determined at the beginning of the previous program to use universities and state agencies to perform the work because these organizations had already performed research in the particular areas, had basic staffs and departments capable of performing the research, and were designated by the state executives. The experience of these organizations has been further enhanced by the work they have conducted for DOE during the past seven years.

RECOMMENDED:

R E Wood

R. E. Wood, Director
Energy and Technology Division

CONCUR:

George C. Wingerson
Office of the Chief Counsel

J. F. Marmo 2/5/84

J. F. Marmo, Director
Contracts Management Division

APPROVED:

Troy E. Wade

Troy E. Wade, Manager
Idaho Operations Office

2/7/84
Date

Arrived @ ESL
29 May '84

STATEWIDE GEOTHERMAL ENERGY PROGRAM FOR NEW MEXICO

Addendum to the

Proposal Submitted to the U.S. Department of Energy
Idaho Operations Office

by

New Mexico Energy Research and Development Institute
1220 South St. Francis Drive
Room 358, Pinon Building
Santa Fe, New Mexico 87501

in cooperation with

State of New Mexico Energy and Minerals Department
525 Camino de los Marquez
Santa Fe, New Mexico 87501

Signature: Larry Icerman

Larry Icerman
Principal Investigator

May 1984

Background

This proposal is submitted by the New Mexico Energy Research and Development Institute (NMERDI) in conjunction with the New Mexico Energy and Minerals Department (EMD). The proposed effort requires a funding level of $90,000 from the U.S. Department of Energy to continue the State's geothermal well drilling programs focused on reservoir characterization and definition.

Approach

Previous work by the NMERDI and EMD has identified eight major areas which are in current need of further attention and support. These areas are:

(1) electrical-grade reservoir definition;

(2) moderate- to intermediate-temperature reservoir characterization;

(3) temperature gradient drilling;

(4) engineering assistance;

(5) agribusiness development;

(6) municipal utility development;

(7) space heating; and

(8) resource mapping.

The State of New Mexico proposes to supplement the current support in the first three areas by utilizing funds secured by this proposal. The remaining five topical areas are currently being supported by funds provided by NMERDI and EMD. The Director of NMERDI and the Secretary of EMD will develop requests for proposals (RFPs) in each of the first three areas and issue a

statewide call for proposals. The NMERDI and EMD will review all proposals submitted and staff from each agency will make award recommendations to the Director and Secretary. The Director and Secretary will determine the awards and the Director will make the awards. The NMERDI will administer and monitor all contracts developed under this proposal. Although the RFPs have yet to be developed, the focus will generally be as follows.

Electrical-Grade Reservoir Definition

The objective of this RFP would be to further the evaluation of potential electrical-grade geothermal sites in New Mexico. New Mexico currently has one proven electrical-grade site at the Valles Caldera and has potential sites at Animas, Hillsboro, Radium Springs, and San Diego Mountain. There are 11 other sites statewide that have inferred electrical potential. The RFP would call for cost-shared proposals focusing on slim hole test drilling in areas with inferred electrical potential.

One or more 2,000- to 3,500-foot slim holes will be drilled contingent upon substantial cost sharing (i.e., a minimum of a 50-50 match) by the leaseholder. Potential private sector respondents to this RFP include: AMAX, Aminoil, Chevron, Crown Geothermal, Hunt Energy, Occidental, Union Geothermal, and Trans-Pacific Geothermal. The primary purpose of this activity is the confirmation of reservoir temperatures. Successful completion of this effort would expand the State's data and information base on electrical-grade geothermal sites and would make this information available in the public sector.

Moderate- to Intermediate-Temperature Reservoir Characterization

The objective of this RFP would be to stimulate reservoir characterization drilling and/or geothermal pre-production well drilling and to facilitate the transfer of site-specific geothermal information to the general public and potential users. A call for proposals would be developed stating that the State would be willing to enter into a fixed-sum, cost-shared drilling program with a geothermal developer(s) in exchange for specific geothermal information.

One or more 1,500- to 2,500-foot test holes will be drilled contingent upon substantial cost sharing by the landowner or leaseholder. The most likely applicants for this program are: City of Las Cruces, Crown Geothermal, New Mexico State University, and Trans-Pacific Geothermal. Crown and Trans-Pacific have already expended considerable funds in cost-shared drilling programs with NMERDI and EMD. The City of Las Cruces is seriously considering the purchase of a substantial lease position adjacent to the metropolitan area and has already undertaken a preliminary cost analysis study. A second more comprehensive study cost shared with EMD will be initiated in the near future.

The State of New Mexico on behalf of New Mexico State University (NMSU) has committed about $1.5 million to the development of one of the largest geothermal energy direct-use applications in the U.S. The NMERDI and EMD have already jointly

committed approximately $200,000 toward further reservoir characterization work and NMSU has expressed a willingness to match additional funds from the Department of Energy on a one-to-one basis. Anticipated results include increased geothermal well drilling and increased availability of geothermal data and information.

Temperature Gradient Drilling

The objective of this RFP would be to encourage temperature gradient drilling in potential geothermal resource areas in New Mexico. A call for proposals would be developed indicating that the State would be willing to enter into a fixed-sum, cost-shared temperature gradient drilling program with landowners or lease-holders to further delineate potential sites for deeper exploratory drilling. As the result of the $15,000 NMERDI financial contribution, this program would consist of many (i.e., up to 30 or more) shallow (e.g., 100- to 300-foot) temperature gradient holes. In New Mexico, this exploration technique has been proven to be cost-effective for definition of a full range of low-, moderate-, intermediate-, and electrical-grade geothermal energy sites.

Potential respondents to this RFP include: AMAX, City of Las Cruces, Monterey Energy, Occidental, Stagecoach Petroleum, and Trans-Pacific Geothermal. Any successful applicant will be required to provide a minimum of a 50-50 financial match. Increased temperature gradient drilling, expanded availability of geothermal data in the public domain, and the definition of new

locations for deeper exploratory drilling are the anticipated results of this program.

Organization

Larry Icerman, NMERDI Director, will serve as the Principal Investigator of the proposed drilling project. Dr. Icerman has been actively involved in New Mexico's geothermal energy development since 1980 and has been Principal Investigator for more than 20 geothermal research, development, and commercialization projects valued at over $1.5 million. He has extensive management and field experience in geothermal drilling programs in New Mexico and is the editor, co-editor, author, or co-author of more than 30 papers and reports on geothermal energy exploration and development. Dr. Icerman will work closely with the Secretary of EMD, Paul Biderman, who has statutory responsiblity for overseeing all energy management activities in the State.

Project Duration

An 18-month project period is proposed (see Fig. 1). This schedule will allow adequate time for the preparation of RFPs, evaluation of proposals, selection of successful proposals, and negotiation of contracts, while still leaving sufficient time to conduct the drilling programs and report on the results.

Deliverables

The results of the proposed project will be reported on in the form of a comprehensive final technical report describing in detail the results of all three drilling programs. This report will be edited by the Principal Investigator. Public dissemination of the information will be provided through the established NMERDI information dissemination program. This effort distributes approximately 5,000 copies of research and development reports annually.

Budget

The revised budget detail outlines the commitment and expenditure of funds under this addendum. Substantial administrative costs will be borne by the NMERDI and EMD. The State considers administrative costs to be a contribution not a match.

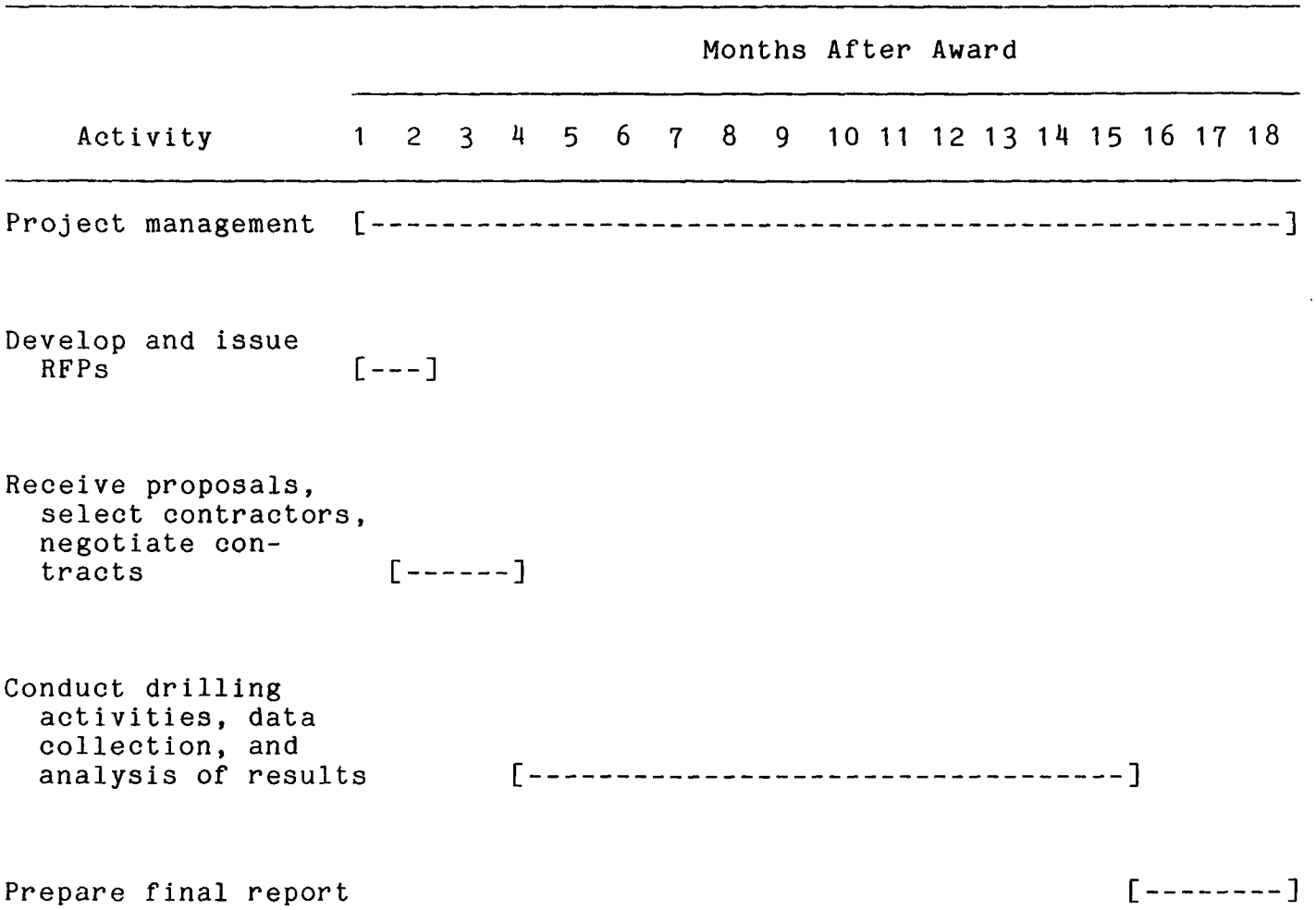


Figure 1. Project Milestone Chart

Revised Budget Detail

	Funding Source		
	DOE	NMERDI	EMD
Administration	$ 10,500	$ 4,000	$1,000
(Personnel Services, Benefits Travel, Supplies, Telephone, Copying, Mailing)			
Report Preparation and Publication	$ 2,000	-0-	-0-
Contractual Drilling Programs* (RFP Categories)	$ 77,500	15,000	-0-
Subtotals	$ 90,000	$ 19,000	$ 1,000
Total Program Costs		$110,000	
Amount Requested from DOE		$ 90,000	
State Contribution Administration Cost Waiver		$ 5,000	
Contractual Drilling Program		$ 15,000	

*Approximate Distribution of Drilling Funds

	DOE	NMERDI
Electrical-Grade Reservoir Definition	$30,000	-0-
Moderate- to Intermediate-Temperature Reservoir Characterization	30,000	-0-
Temperature Gradient Drilling	17,500	$15,000
Total	$77,500	$15,000

Rec 6/9/88
HAR

New Mexico Research and Development Institute

DIRECTOR
Larry Icerman

June 7, 1988

Dr. Howard P. Ross
University of Utah Research
Institute
Earth Science Laboratory
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108

RE: Grant No. DE-FG07-84ID12546

Dear Dr. Ross:

Please find enclosed one (1) copy of the Final Technical Report for the above Grant. I hope you find the report both informative and professionally prepared.

If you have any questions regarding the report, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:jg

cc: File DE-FG07-84ID12546

(7-81)

NOTICE OF FINANCIAL ASSISTANCE AWARD

(See Instructions on Reverse)

Ross

Rec 9/3/87

Under the authority of Public Law 93-410 and subject to legislation, regulations and policies applicable to *(cite legislative program title)*:

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE
Research on Geothermal Resources in New Mexico

2. INSTRUMENT TYPE
☒ GRANT ☐ COOPERATIVE AGREEMENT

3. RECIPIENT *(Name, address, zip code, area code and telephone no.)*
New Mexico Research and Development Inst.
1220 St. Frances Drive Room 358
Pinion Bldg., Santa Fe, NM 87501

4. INSTRUMENT NO.
DE-FG07-84ID12546

5. AMENDMENT NO.
M003

6. BUDGET PERIOD
FROM: 9/30/86 THRU: 12/31/87

7. PROJECT PERIOD
FROM: 9/7/84 THRU: 12/31/87

8. RECIPIENT PROJECT DIRECTOR *(Name and telephone No.)*
Larry Icerman (505) 827-5886

9. RECIPIENT BUSINESS OFFICER *(Name and telephone No.)*
Same

10. TYPE OF AWARD
☐ NEW ☐ CONTINUATION ☒ RENEWAL
☐ REVISION ☐ SUPPLEMENT

11. DOE PROJECT OFFICER *(Name, address, zip code, telephone No.)*
Peggy Brookshier (208) 526-1403
U.S. DOE, Idaho Operations Office
785 DOE Place, Idaho Falls, ID 83402

12. ADMINISTERED FOR DOE BY *(Name, address, zip code, telephone No.)*
R. Jeffrey Hoyles (208) 526-0790
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

13. RECIPIENT TYPE
☒ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☐ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☐ C ☐ P ☐ SP ☐ OTHER *(Specify)*

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION		b. CUMULATIVE DOE OBLIGATIONS	
(1) DOE Funds Obligated This Action	$ -0-	(1) This Budget Period [Total of lines a.(1) and a.(3)]	$ 109,970
(2) DOE Funds Authorized for Carry Over	$ 101,143	(2) Prior Budget Periods	$ -0-
(3) DOE Funds Previously Obligated in this Budget Period	$ 109,970		
(4) DOE Share of Total Approved Budget	$ 109,970		
(5) Recipient Share of Total Approved Budget	$ 131,750	(3) Project Period to Date [Total of lines b. (1) and b. (2)]	$ 109,970
(6) Total Approved Budget	$ 241,720		

17. TOTAL ESTIMATED COST OF PROJECT $ _____

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations *(specify)* _____ *(Date)* _____

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☒ B (Grants) or ☐ C (Cooperative Agreements).

d. Application/proposal dated 6/8/86, ☐ as submitted ☒ with changes as negotiated

19. REMARKS

The current Statement of Work (Amendment 002) is hereby deleted in its entirety. Substitute in lieu thereof the attached Statement of Work. All other terms and conditions remain the same.

20. EVIDENCE OF RECIPIENT ACCEPTANCE

Larry Icerman 8/18/87
(Signature of Authorized Recipient Official) *(Date)*

Larry Icerman
(Name)

Director
(Title)

21. AWARDED BY

R. Jeffrey Hoyles 8/12/87
(Signature) *(Date)*

R. Jeffrey Hoyles
(Name)

Contracting Officer
(Title)

New Mexico Research and Development Institute
(formerly New Mexico Energy Research and Development Institute)
Grant No. DE-FG07-84ID12546

STATEMENT OF WORK

1.0 Introduction

The goal of this grant modification is to support cost-shared research on geothermal resources in New Mexico. This will be accomplished through reprogramming previously allocated funds. The unspent monies were previously allocated through the State Cooperative Program for geothermal research in New Mexico. The reprogramming of a portion of these monies has become necessary because of litigation which prohibits access to the lands on which the reservoir hydrology study in the Animas Valley was to be completed. Other technical tasks included in the subject grant are unaffected and will be completed as scheduled.

This modification provides for the completion of Task 4.1, Compilation of Geothermal Data for South-central New Mexico, and Task 4.2.1.a, Review and Evaluate Existing Hydrologic Data, Animas Valley, and the preparation of reports for these tasks. A new research program, Geothermal Resource Assessment of the Orogrande, New Mexico Area, replaces much of the new data collection for the Geothermal Reservoir Hydrology of the Animas Valley study. The geothermal resource assessment study of the Orogrande area takes advantage of a unique opportunity afforded by geotechnical borings and the drilling of a water well on the U.S. Army White Sands Missle Range located near Orogrande. This drilling is in close proximity to the Jarilla Fault Zone which is believed to be one of the major structural controls for high temperature fluids encountered in oil exploration holes in the area. Temperature logs, lithologic data, and hydrologic data will be obtained in this relatively unstudied resource area without the major expense of a drilling program.

2.0 Scope

The technical objectives of this grant modification are to determine the subsurface temperature distribution in the vicinity of the Jarilla Fault Zone near Orogrande, New Mexico and to evaluate these and related data to complete a preliminary resource assessment for the area. The technical efforts are described in 4.0 below. Program tasks 4.1 and 4.2 will be cost-shared by DOE and other program participants. The research will be completed within the project period previously specified for this grant, which ends on December 31, 1987. Final technical reports for each task will be prepared.

3.0 Applicable Documents

The effort described herein is a modification of DOE Grant

DE-FG07-84ID12546, Amendment No. A002, as requested through a letter and proposal from the New Mexico Research and Development Institute dated June 23, 1987. The grant and Amendment A002 commit the Research and Development Institute and Lightning Dock Geothermal to cost share in the proposed efforts. The cost sharing will continue in this amendment.

4.0 Technical Tasks

The following tasks will be accomplished through this grant modification.

4.1 Compilation of Geothermal Data for South-central New Mexico

4.1.1 Compile data to prepare maps of seven different parameters. This compilation will be cost shared with the New Mexico Research and Development Institute. The tasks are:

a. Compile a location map and list of data sources

b. Compile all existing heat flow data

c. Compile temperature gradient data from all available holes

d. Compile tectonic and geologic data, to develop a geologic map including Tertiary subcrops, pre-Tertiary lithology distribution and geologic structures. Where appropriate, other Tertiary and younger geologic features relevant to geothermal resources, such as volcanic vents, should also be indicated.

e. Compile water table elevations, to indicate groundwater flow regimes, such as zones of recharge, discharge, and flow constriction

f. Compile depths to water table

g. Compile locations of site-specific studies

No original data will be collected; only data available from previous studies will be used. The maps will be compiled at a scale of at least 1:500,000; they will be reduced to 8 1/2 by 11 inch page size for the final report. The larger maps will be made available to interested researchers through open-file or other appropriate procedures.

4.3.2 Coordinate with Fluor Constructors, Corps of Engineers, and the USGS in the planning and drilling of a 1200 foot hydrologic test well. Complete temperature surveys after drilling and again after temperature equilibrium conditions have been established. Determine temperature gradient profile and heat flow. Perform analyses on geophysical logs, drill cuttings, water quality data, temperature data, and pump test data.

4.3.3 Data Evaluation and Interpretation

Evaluate and interpret all the data collected in Tasks 4.3.1 and 4.3.2 and existing published or available geologic, geophysical, geochemical and hydrologic data to develop a preliminary assessment of the geothermal energy potential of the Orogrande, New Mexico area including the adjacent portions of the U.S. Army White Sands Missle Range. Evaluate the Jarilla Fault Zone as a controlling structure for geothermal fluids in this area, and locate this feature with respect to the 1200 foot drill hole and other data base items.

4.3.4 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task. All new data obtained as a result of funding for this task will be summarized in the technical report.

5.0 Reports, Data, and Other Deliverables

5.1 Management Records

Reports will be due as indicated on the Federal Assistance Reporting Checklist and the Report Distribution List.

5.2 Final Technical Reports

5.2.1a Final report, south-central New Mexico

A detailed final technical report will be prepared. The report will describe all data tables, maps, methods of research and data reduction. The report will also analyze and discuss interpretations of heat-flow, tectonic, and groundwater flow information. Various models of geothermal resources derived from site-specific studies will be analyzed within a regional framework. The report will include a complete bibliography of data sources and references.

5.2.1b Final report, Animas Valley

A technical report will be prepared which describes and summarizes the review and evaluation of existing thermal and hydrologic data and provides a preliminary resource assessment of the Animas Valley geothermal resource area. A complete bibliography of data sources and references will be included. All proprietary data made available by Lightning Dock Geothermal to this project, including but not limited to data from well 55-7, thermal measurements, water chemical analyses, and other appropriate geologic and hydrologic data, will be made available to the public as part of the final report.

5.2.1c Final report, Orogrande geothermal resource assessment

A final report will be prepared which presents the new geologic, thermal and hydrologic data resulting from the shallow boreholes and the 1200 foot water test well. These data will be integrated with other relevant geologic, geophysical, geochemical and hydrologic data to arrive at a preliminary resource assessment for the Orogrande area and the Jarilla Fault Zone area in the Tularosa Basin.

5.2.2 The final reports for each task may be produced and published in one volume, in conjunction with other appropriate documents.

6.0 Special Considerations

Successful completion of the technical tasks described above is contingent upon DOE cost-sharing these efforts with other program participants. For the study of south-central New Mexico, the New Mexico Research and Development Institute will provide additional funding. For the study of the Animas Valley, additional funding will be provided by Lightning Dock Geothermal, through an agreement with the New Mexico Research and Development Institute. Lightning Dock Geothermal will provide temperature logging equipment at no cost for the Orogrande study. Centralized management and project reporting for this program will be through the New Mexico Research and Development Institute.

Rec 2/1/88

New Mexico Research and Development Institute

DIRECTOR
Larry Icerman

January 29, 1988

Dr. Howard P. Ross
University of Utah Research
Institute
Earth Science Laboratory
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108

Re: Grant No. DE-FG07-84ID12546 Draft Final Technical Report

Dear Dr. Ross:

Please find enclosed one (1) copy of the draft final technical report for Grant No. DE-FG07-84ID12546. I trust you will be pleased with the results of the work and the quality of the report.

If you have any questions on this draft, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:asl

cc: File DE-FG07-84ID12546

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

New Mexico Research and Development Institute
(formerly New Mexico Energy Research and Development Institute)
Grant No. DE-FG07-84ID12546

STATEMENT OF WORK

1.0 Introduction

The goal of this grant modification is to support cost-shared research on geothermal resources in New Mexico. This will be accomplished through reprogramming previously allocated funds. The unspent monies were previously allocated through the State Cooperative Program for geothermal research in New Mexico. The reprogramming of a portion of these monies has become necessary because of litigation which prohibits access to the lands on which the reservoir hydrology study in the Animas Valley was to be completed. Other technical tasks included in the subject grant are unaffected and will be completed as scheduled.

This modification provides for the completion of Task 4.1, Compilation of Geothermal Data for South-central New Mexico, and Task 4.2.1.a, Review and Evaluate Existing Hydrologic Data, Animas Valley, and the preparation of reports for these tasks. A new research program, Geothermal Resource Assessment of the Orogrande, New Mexico Area, replaces much of the new data collection for the Geothermal Reservoir Hydrology of the Animas Valley study. The geothermal resource assessment study of the Orogrande area takes advantage of a unique opportunity afforded by geotechnical borings and the drilling of a water well on the U.S. Army White Sands Missle Range located near Orogrande. This drilling is in close proximity to the Jarilla Fault Zone which is believed to be one of the major structural controls for high temperature fluids encountered in oil exploration holes in the area. Temperature logs, lithologic data, and hydrologic data will be obtained in this relatively unstudied resource area without the major expense of a drilling program.

2.0 Scope

The technical objectives of this grant modification are to determine the subsurface temperature distribution in the vicinity of the Jarilla Fault Zone near Orogrande, New Mexico and to evaluate these and related data to complete a preliminary resource assessment for the area. The technical efforts are described in 4.0 below. Program tasks 4.1 and 4.2 will be cost-shared by DOE and other program participants. The research will be completed within the project period previously specified for this grant, which ends on December 31, 1987. Final technical reports for each task will be prepared.

3.0 Applicable Documents

The effort described herein is a modification of DOE Grant

DE-FG07-84ID12546, Amendment No. A002, as requested through a letter and proposal from the New Mexico Research and Development Institute dated June 23, 1987. The grant and Amendment A002 commit the Research and Development Institute and Lightning Dock Geothermal to cost share in the proposed efforts. The cost sharing will continue in this amendment.

4.0 Technical Tasks

The following tasks will be accomplished through this grant modification.

4.1 Compilation of Geothermal Data for South-central New Mexico

4.1.1 Compile data to prepare maps of seven different parameters. This compilation will be cost shared with the New Mexico Research and Development Institute. The tasks are:

a. Compile a location map and list of data sources

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c. Compile temperature gradient data from all available holes

d. Compile tectonic and geologic data, to develop a geologic map including Tertiary subcrops, pre-Tertiary lithology distribution and geologic structures. Where appropriate, other Tertiary and younger geologic features relevant to geothermal resources, such as volcanic vents, should also be indicated.

e. Compile water table elevations, to indicate groundwater flow regimes, such as zones of recharge, discharge, and flow constriction

f. Compile depths to water table

g. Compile locations of site-specific studies

No original data will be collected; only data available from previous studies will be used. The maps will be compiled at a scale of at least 1:500,000; these will be reduced to 8 1/2 by 11 inch page size for the final report. The larger maps will be made available to interested researchers through open-file or other appropriate procedures.

4.1.2 Final Report

A final report, described under 5.2.1, will be prepared as part of this task.

4.2 Geothermal Reservoir Hydrology of the Animas Valley

4.2.1a Review and evaluate existing hydrologic data in the area of geothermal anomalies in the Animas Valley. This effort will be cost shared with Lightning Dock Geothermal.

Include all data and reports available in the public domain, and previously proprietary data being made available through this study. These data include detailed water chemistry, temperature surveys, or hydrographic data from about 60 irrigation wells, and previously proprietary water chemistry and temperature surveys from 12 shallow geothermal wells. Reinterpret all data, including data from well 55-7. Evaluate these data to determine, to the extent possible, drawdown due to geothermal fluid extraction and the potential for communication between geothermal and irrigation wells. Systematically evaluate the temperature, mineral content, and water level for approximately 72 wells.

4.2.2 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task.

4.3. Geothermal Reservoir Assessment of the Orogrande Area, Tularosa Basin, New Mexico

4.3.1 Test Borings/Temperature-Gradient Holes

Review soil test boring results in cooperation with the Corps of Engineers to determine lithologies penetrated and any evidence of geothermal fluids and proximity to the Jarilla Fault Zone. Complete soil test borings as thermal gradient holes and log these holes for temperature distribution for relevant boreholes that become available during the field study period. Use standard field procedures for hole completion and temperature logging. Analyze geologic and temperature data obtained and prepare geologic and/or temperature contour maps. Temperature logging equipment will be made available by Lightning Dock Geothermal at no cost to the project.

4.3.2 Coordinate with Fluor Constructors, Corps of Engineers, and the USGS in the planning and drilling of a 1200 foot hydrologic test well. Complete temperature surveys after drilling and again after temperature equilibrium conditions have been established. Determine temperature gradient profile and heat flow. Perform analyses on geophysical logs, drill cuttings, water quality data, temperature data, and pump test data.

4.3.3 Data Evaluation and Interpretation

Evaluate and interpret all the data collected in Tasks 4.3.1 and 4.3.2 and existing published or available geologic, geophysical, geochemical and hydrologic data to develop a preliminary assessment of the geothermal energy potential of the Orogrande, New Mexico area including the adjacent portions of the U.S. Army White Sands Missle Range. Evaluate the Jarilla Fault Zone as a controlling structure for geothermal fluids in this area, and locate this feature with respect to the 1200 foot drill hole and other data base items.

4.3.4 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task. All new data obtained as a result of funding for this task will be summarized in the technical report.

5.0 Reports, Data, and Other Deliverables

5.1 Management Records

Reports will be due as indicated on the Federal Assistance Reporting Checklist and the Report Distribution List.

5.2 Final Technical Reports

5.2.1a Final report, south-central New Mexico

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5.2.1b Final report, Animas Valley

A technical report will be prepared which describes and summarizes the review and evaluation of existing thermal and hydrologic data and provides a preliminary resource assessment of the Animas Valley geothermal resource area. A complete bibliography of data sources and references will be included. All proprietary data made available by Lightning Dock Geothermal to this project, including but not limited to data from well 55-7, thermal measurements, water chemical analyses, and other appropriate geologic and hydrologic data, will be made available to the public as part of the final report.

5.2.1c Final report, Orogrande geothermal resource assessment

A final report will be prepared which presents the new geologic, thermal and hydrologic data resulting from the shallow boreholes and the 1200 foot water test well. These data will be integrated with other relevant geologic, geophysical, geochemical and hydrologic data to arrive at a preliminary resource assessment for the Orogrande area and the Jarilla Fault Zone area in the Tularosa Basin.

5.2.2 The final reports for each task may be produced and published in one volume, in conjunction with other appropriate documents.

6.0 Special Considerations

Successful completion of the technical tasks described above is contingent upon DOE cost-sharing these efforts with other program participants. For the study of south-central New Mexico, the New Mexico Research and Development Institute will provide additional funding. For the study of the Animas Valley, additional funding will be provided by Lightning Dock Geothermal, through an agreement with the New Mexico Research and Development Institute. Lightning Dock Geothermal will provide temperature logging equipment at no cost for the Orogrande study. Centralized management and project reporting for this program will be through the New Mexico Research and Development Institute.

New Mexico Contract 12/31/87

REPORTS & DISTRIBUTION
New Mexico
1986

U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
REPORT DISTRIBUTION LIST

Addressees	Federal Assistance Milestone Plan	Federal Assistance Budget Information Form	Federal Assistance Management Summary Report	Federal Assistance Program/Project Status Report	Financial Status Report, OMB Form 269	Notice of Energy RD&D	Technical Progress Report	Topical Report	Final Technical Report
U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, ID 83401									
Attn: Peggy Brookshier, Prog. Mgr. Energy & Technology Division			2	2				8*	8*
Attn: Elizabeth M. Hyster Contracts Management Div.			1	1	1	1		1	1
Attn: E. G. Jones, Director Financial Management Div.			1						
U. S. Department of Energy Forrestal Bldg., CE-~~324~~ 342 1000 Independence Ave, S.W. Washington, DC 20585 Attn: Marshall Reed			1	1				2	2
University of Utah Research Institute Earth Science Laboratory 391 Chipeta Way, Suite A Salt Lake City, UT 84108 Attn: Duncan Foley			1	1				1	1
U. S. Department of Energy Technical Information Center P. O. Box 62 Oak Ridge, TN 37830						1			

Special Instructions

*One camera-ready copy must be included.

	REPORT	DUE
(1)	Form DOE 538 Notice of Energy RD&D	30 days after award of grant
(2)	Quarterly Management Summary Report	15 days after calendar quarter end
(3)	Project Status Report	15 days after calendar quarter end
(4)	Final Report (Draft)	Due 45 days prior to completion date
(5)	Final report	Due on completion date
(6)	Financial Status Report - OMB Form 269	Due annually and upon completion

The deliverables resulting from the tasks outlined above which will be delivered to DOE are summarized as follows:

1. The Final report--one camera-ready copy plus twelve additional copies--will be distributed as specified in the attached DOE Form EIA 459A.

2. Reports previously described under Task 5 above will be prepared and issued in the amounts and at the frequency shown.

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA 459A
(10/80)

FORM APPROVED
OMB NO 1900-0127

1. Identification Number: DE-FG07	2. Program/Project Title: Geothermal
3. Recipient:	

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
☐ Federal Assistance Milestone Plan			
☐ Federal Assistance Budget Information Form			
☒ Federal Assistance Management Summary Report	Q		
☒ Federal Assistance Program/Project Status Report	Q		
☒ Financial Status Report, OMB Form 269	Y, F		
TECHNICAL INFORMATION REPORTING			
☒ Notice of Energy RD&D	Y		
☐ Technical Progress Report			
☒ Topical Report	A*		
☒ Final Technical Report	F*		

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final: Upon completion date
Q - Quarterly; within 15 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

* Draft copy due 45 days prior to completion date.

6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)

M E M O R A N D U M

To: Peggy Brookshier

From: Howard Ross

Please review the enclosed as the proposed Amendment No. 3 for the NMRDI grant, DOE State Cooperative Program. Larry Icerman has read this SOW and agrees to this wording. Please call me after your study of the suggested SOW. I will make the necessary changes in the text and then forward a letter quality copy to your office.

Best Regards,

Howard Ross

New Mexico Research and Development Institute

June 23, 1987

DIRECTOR
Larry Icerman

Dr. Howard P. Ross
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108

RE: Reprogramming of Funds under Grant No. DE-FG07-84ID12546

Dear Dr. Ross:

Pursuant to our brief discussion on June 3, 1987, please find enclosed a copy of a third addendum to the November 1985 reprogramming of some of the funds under the above grant. As you know, this third addendum has become necessary as the result of litigation prohibiting access to the lands on which the reservoir hydrology work in the Animas Valley was scheduled.

The requested reprogramming plan identifies an excellent and extraordinarily unique target of opportunity for preliminary resource assessment work. This work can be performed by the staff of one of the current subcontractors in a time frame that will not require a modification of the performance period of the above grant. This addendum includes a detailed work plan and a revised budget.

To expedite the review process, I have also forwarded copies of this addendum to Peggy Brookshire (see enclosed letter). I will contact you before the end of June to discuss the addendum in greater detail and to address any specific questions you may have. Thank you for your assistance in this matter.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:jg

cc: File DE-FG07-84ID12546

New Mexico Research and Development Institute

June 23, 1987

DIRECTOR
Larry Icerman

Ms. Peggy Brookshire
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

RE: Reprogramming of Funds under Grant No. DE-FG07-84ID12546

Dear Ms. Brookshire:

Pursuant to an informal discussion with Howard Ross, please find enclosed two (2) copies of a third addendum to the November 1985 reprogramming of some of the funds under the above grant. This third addendum has become necessary as the result of litigation prohibiting access to the lands on which the reservoir hydrology work in the Animas Valley was scheduled.

The requested reprogramming plan identifies an excellent and extraordinarily unique target of opportunity for preliminary resource assessment work. This work can be performed by the staff of one of the current subcontractors in a time frame that will not require a modification of the performance period of the above grant. This addendum includes a detailed work and a revised budget.

I hope that you will give favorable consideration to this addendum to the reprogramming plan. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:jg

cc: Howard P. Ross, URRI
File DE-FG07-84ID12546

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

STATEWIDE GEOTHERMAL ENERGY PROGRAM FOR NEW MEXICO

Reprogramming of Funds under
Grant No. DE-FG07-84ID12546

Third Addendum to the November 1985
Request Submitted to the U.S. Department of Energy
Idaho Operations Office

by

New Mexico Research and Development Institute
1220 South St. Francis Drive
Pinon Building, Suite 358
Santa Fe, New Mexico 87501

Larry Icerman
Principal Investigator

June 1987

Background

A request for reprogramming of funds under U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12546 was submitted by the New Mexico Energy Research and Development Institute in November 1985 to make funds available to carry out three new program opportunities: (1) resource mapping; (2) reservoir hydrology; and (3) engineering assistance. Verbal approval from DOE was received for the work proposed in principle under items (1) and (2). The engineering assistance activities were judged to not be an appropriate reprogramming of funds.

In May and June 1986, respectively, detailed work plans in the areas of resource mapping and reservoir hydrology were submitted to and approved by DOE. The work under the topic of resource mapping (First Addendum) has progressed smoothly and is now in draft form as part of the full final report to be submitted under Grant No. DE-FG07-84ID12546.

The work under the topic of reservoir hydrology (Second Addendum) started in October 1986 and progressed smoothly until December 1986 when litigation concerning the rights to the lands under assessment became evident. Initially, this litigation appeared to be resolvable in a timely fashion; however, many months, if not years, are now projected to be required for a settlement to be reached. Lightning Dock Geothermal, Inc. (LDG), the subcontractor to the New Mexico Research and Development Institute (NMRDI), is not involved in the litigation directly but has, as the result of the litigation, been denied access to the lands under dispute, which constitute a significant and crucial

fraction of the hydrological assessment area. In order to ensure that DOE funds would not be used for work that could not be reported on, NMRDI suspended the subcontract to LDG on December 11, 1986. Since that time, NMRDI and LDG have pursued alternative approaches to perform the reservoir hydrology work in the Animas Valley without success.

Consequently, this third addendum is submitted as a request to reprogram the remaining balance of the funds ($41,200 of $47,500) allocated to the reservoir hydrology work to pursue a geothermal resource assessment target of opportunity that has been identified as the result of the Department of Defense selecting the U.S. Army White Sands Missile Range as the site for the construction of the Ground Based Free Electron Laser (GBFEL) Facility. This facility will be located near Orogrande in Otero County, New Mexico.

This addendum contains a detailed work plan associated with this target of opportunity resource assessment work and a proposed revised budget. The reprogramming plan proposes to utilize the same LDG staff assigned to the reservoir hydrology work to carry out the reprogrammed work on day-to-day basis. Because of the uniqueness and time frame of the target of opportunity that has been identified, the performance period for Grant No. DE-FG07-84ID12546 should not require modification.

Target of Opportunity Resource Assessment

Introduction

Orogrande, New Mexico, is located at the southern extent of the Tularosa Basin, which is part of the Basin and Range Province

and is on the eastern boundary of the southern Rio Grande rift (see Figure 1). Because this area has been under continuous control of the U.S. Army for more than forty years, very limited data are available from which the geothermal energy potential may be assessed. This target of opportunity to conduct preliminary resource assessment work represents an unusual chance to collect data because once the GBFEL construction has been completed access to this site will once again be restricted.

McLean (1970) has summarized the geology and hydrology of the Tularosa Basin. Seager (1980, 1982) has developed a comprehensive analysis and model of the western, basin-bounding mountains and fault structure. The Jarilla Fault Zone is postulated (King and Harder, 1982) to be one of the major structural controls for potential geothermal resources in the eastern Tularosa Basin. Although the Jarilla Fault Zone has not been mapped in detail, the southern extent of the fault is inferred (see Figure 2) to be nearby the location selected for the GBFEL site.

Research Design

During the summer of 1987, considerable geotechnical work will be conducted by the U.S. Army Corps of Engineers in support of the construction of the GBFEL. Approximately 40 soil test borings to depths ranging from 40 to 200 feet will be made. In addition, Fluor Constructors, the principal construction contractor for GBFEL, will drill a water test well to a planned depth of 1,200 feet. Only limited geophysical logs and test pumping are planned. The proposed research methodology is to capitalize on this once-in-a-lifetime target of opportunity presented by the

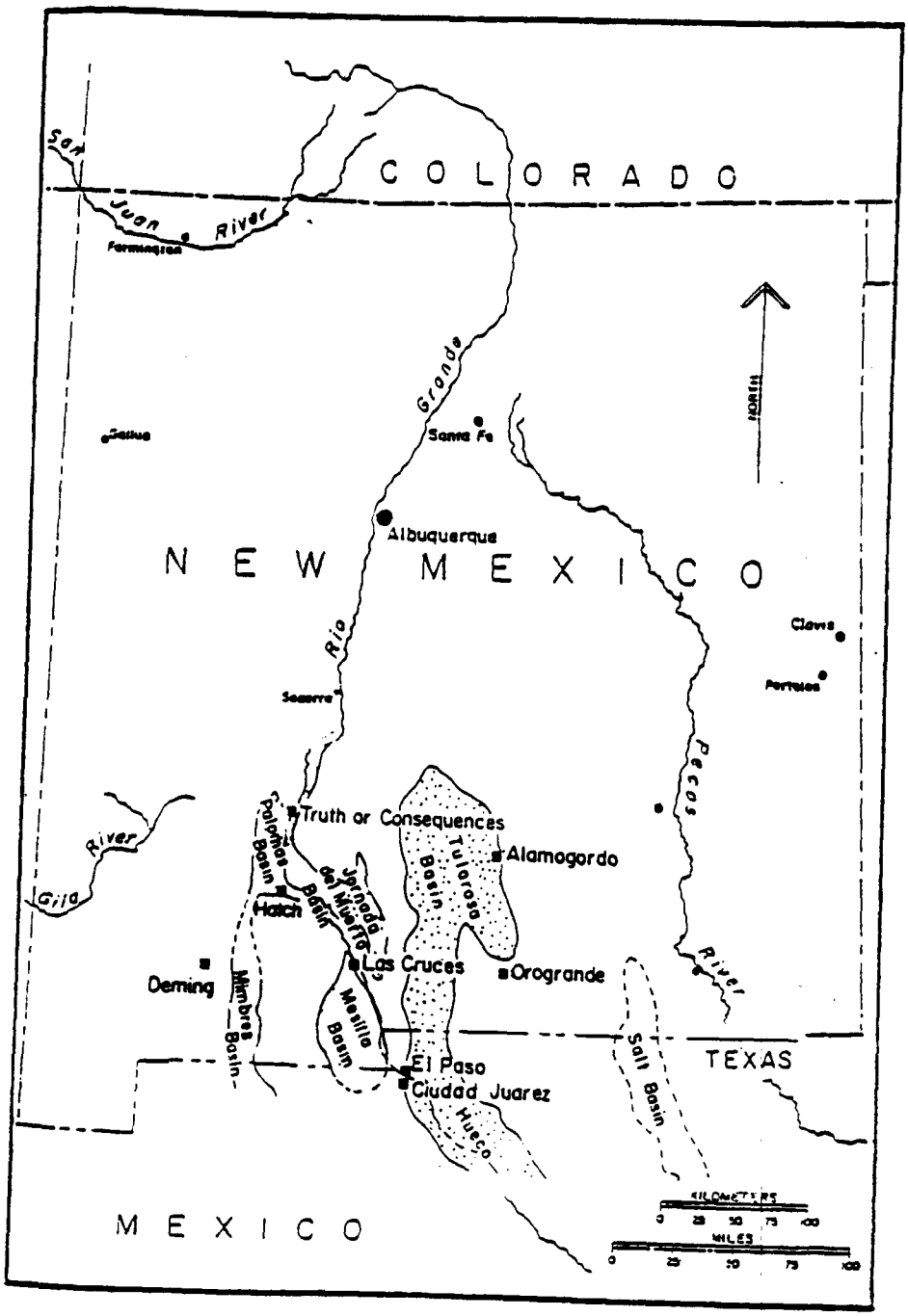

Figure 1. Location Map for the Tularosa Basin.

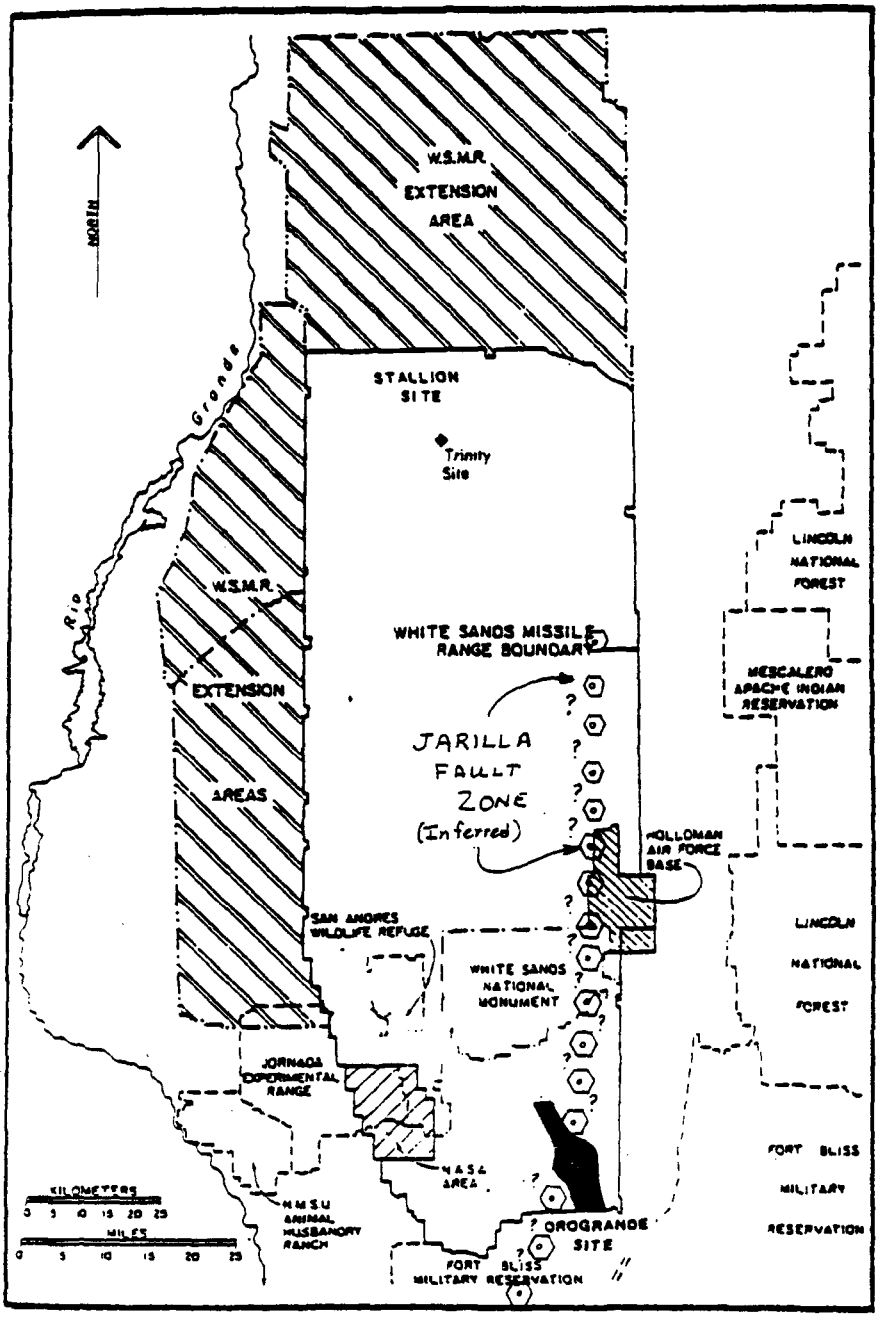

Figure 2. Inferred Location of the Jarilla Fault Zone Intersecting the Site of the Ground Based Free Electron Laser Facility.

geotechnical work to performed by the Corps by conducting detailed geophysical and hydrological resource assessment work in conjunction with the test borings and the test water well. Informal coordination has already been made with the Corps, both the Huntsville and the Ft. Worth Districts, the Chief Scientist and Technical Director at White Sands Missile Range, the U.S. Geological Survey (USGS), and the Fluor Constructors Project Manager. The concept of performing additional geophysical and hydrological studies during the summer of 1987 has been received well by these organizations and individuals who are in charge of the planned geotechnical work.

Work Plan

The proposed work will be conducted as two major field tasks. The results of each of these two tasks will be synthesized in a third task to provide a preliminary geothermal resource assessment of the Orogrande area.

Task 1: Test Borings/Temperature-Gradient Holes

In cooperation with the Corps, the planned locations for the soil test borings will be reviewed to select 11 test holes for completion as temperature-gradient holes. The holes will be selected to provide the maximum practical coverage of a zone extending up to six miles in a southeast-northwest alignment to maximize the probability of intersecting the Jarilla Fault Zone. Because the target depths of the test borings range from 40 to 200 feet, a request will be made to the Corps to deepen at least three of the 40-foot holes to a depth of 100 feet so that all of the holes to be completed as temperature-gradient holes will be a

minimum of 100 feet in depth. The 11 temperature-gradient holes will be completed using standard field techniques as part of this reprogrammed work plan. Following the completion of the holes, temperature data will be collected and the holes will be abandoned in accordance with federal and state regulations.

The temperature data will be acquired, using equipment provided by LDG, in three separate time intervals. Analyses of the temperature data will be performed, and temperature-gradient contour maps will be prepared.

Task 2: Water Test Well/Reservoir Assessment

In collaboration with the Corps, USGS, and Fluor Constructors, input will be provided to the planning and drilling of a 1,200-foot test well to maximize the opportunity to collect geophysical and hydrological data for the purpose of making a preliminary geothermal reservoir assessment. This well will be drilled by Fluor Constructors. The work will involve: (1) determination of the geophysical logs and temperature surveys to be acquired; (2) review and approval of the plans for obtaining and analyzing drill cuttings and water samples; and (3) development of a plan to conduct a hydrological assessment of the reservoir based on the scheduled pump tests.

Analyses will be performed on the geophysical logs, temperature data, water quality data, and drill cuttings. Pump test data will be utilized to estimate the hydrological parameters of the potential geothermal reservoir.

Task 3: Data Evaluation and Interpretation

All of the data collected and analyzed in Tasks 1 and 2 will be evaluated and interpreted in order to develop a preliminary assessment of the geothermal energy potential of the Orogrande, New Mexico, area adjacent to the GBFEL facility. A detailed final technical report will be prepared. The report will include all of the data collected, the data analyses, and qualitative and quantitative assessments of the geothermal energy potential of the study area.

Research Staff

Roger Bowers, Vice President of LDG, will supervise and conduct the work related to the geothermal evaluations and analyses. Mr. Bowers is a widely recognized geologist in the geothermal energy community. He served as the Geothermal Program Manager for Hunt Energy Corporation for 12 years. Mr. Bowers directed the extensive geothermal exploration effort by Hunt Energy Corporation in Dona Ana County, New Mexico, in 1982-83.

Mr. Roy Cunniff, President of LDG, will supervise and conduct the engineering aspects of the evaluations and analyses. Mr. Cunniff was the Project Engineer for the highly successful New Mexico State University Campus Geothermal Project. That project included drilling a new production well, an observation well, and a new disposal well. As Project Engineer for the San Bernardino geothermal system, Mr. Cunniff was responsible for the drilling program, in which two deep gradient wells of 1,380 and 1,985 feet were drilled and one new production well was completed in early September 1984. Mr. Cunniff also was the head of the

engineering team that conducted a reservoir assessment of the Radium Springs, New Mexico, geothermal field in May 1983 for Hunt Energy Corporation.

Company Profile

The proposed field studies will be subcontracted to LDG, which was first organized as a partnership in February 1986. Later in 1986, the partners organized and incorporated the company under the laws of the State of New Mexico. The firm originally was incorporated to own and develop the Lightning Dock KGRA in the Animas Valley of New Mexico. The federal geothermal lease, which controls the geothermal direct-heat usage by three different greenhouse firms, and the Test for Discovery Well 55-7, drilled by Steam Reserve Corporation in 1985, are partnership assets in process of being transferred to the Corporation. The company has also purchased lease rights from the State of New Mexico for an additional 1,500 acres adjoining the federal lease. Under its charter, the corporation can engage in geothermal resource assessment, resource development, and associated endeavors.

Program Organization

Larry Icerman, NMRDI Director, will continue to serve as the Principal Investigator of the reprogrammed research. Dr. Icerman has been actively involved in geothermal energy development in New Mexico since 1980 and has been Principal Investigator for more than 20 geothermal research, development, and commercialization projects valued at over $1.5 million. He has extensive management and field experience in geothermal drilling programs

in New Mexico and is the editor, co-editor, author, or co-author of more than 30 papers and reports on geothermal energy exploration and development.

Program Duration

A five-month period is proposed to conduct the reprogrammed work. This schedule will allow adequate time to coordinate the work plan with all involved organizations, to complete the proposed field activities and analyses, while still leaving sufficient time to interpret and report on the results.

Deliverables

The results of all of the work, including the preliminary reservoir hydrology work in the Animas Valley, conducted under Grant No. DE-FG07-84ID12546 will be reported on in the form of a comprehensive final technical report. This report will be edited by Larry Icerman. Public dissemination of the information will be provided through the established NMRDI information dissemination program. This effort distributes approximately 5,000 copies of research and development reports annually.

Budget

The revised budget summary (see Table 1) outlines the commitment and expenditure of funds under this addendum. Substantial administrative costs will be borne by NMRDI. The State of New Mexico considers administrative costs to be a contribution not a match. A budget detail for the reprogrammed work to be performed by LDG as a subcontractor is given in Table 2.

References

King, W.E., and Harder, V.M., 1982, Oil and gas potential of the Tularosa Basin -- Otero platform area, Otero County, New

Mexico: New Mexico Energy Research and Development Institute, EMD 2-68-3205, 69 p.

McLean, J.S., 1970, Saline ground-water resources of the Tularosa Basin, New Mexico: Office of Saline Water, Research and Development Progress Report 561, 128 p.

Seager, W.R., 1980, Quaternary fault system in the Tularosa and Hueco basins, southern New Mexico and West Texas, in Trans-Pecos Region, in 31st Field Conference Guidebook: New Mexico Geological Society, p. 131-136.

Seager, W.R., 1981, Geology of Organ Mountains and southern San Andres Mountains, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Memoir 36, 97 p.

Table 1. Budget Summary

Revised Work Plan

(Third Addendum)

	DOE	NMRDI	EMD	NMSU	LDG
Administration	$ 10,500	$ 6,500	$1,000	-0-	-0-
Personnel Services, Benefits, Travel, Supplies, Telephone, Copying, Mailing					
Report Preparation and Publication	2,000	500	-0-	-0-	-0-
Contractual Programs					
NMSU geothermal well	19,970	-0-	-0-	$50,000	-0-
Resource mapping	30,000	25,000	-0-	-0-	-0-
Reservoir hydrology	6,300	-0-	-0-	-0-	$45,000
Moderate-to-intermediate temperature reservoir characterization (NMSU) well contingency funds)	-0-	-0-	-0-	-0-	-0-
Target of opportunity (Orogrande)	41,200	-0-	-0-	-0-	-0-
Subtotals	$109,970	$32,000	$1,000	$50,000	$45,000
Total Program Costs		$237,970			
DOE Funds		$109,970			
State Contribution					
Administration and Report Preparation Cost Waiver		$ 8,000			
Contractual Programs		$ 75,000			
Lightning Dock Geothermal Contribution		$ 45,000			
Total Contributions		$128,000			

TABLE 2. Subcontractor Budget Detail

	DESCRIPTION	$ COST
TASK 1	TEMPERATURE GRADIENT DATA	
PURCHASED SERVICES		
	AREA 1: COMPLETE 3 HOLES	$600
	AREA 2: COMPLETE 4 HOLES	$2,500
	AREA 3: COMPLETE 4 HOLES	$2,000
	SUBTOTAL	$5,100
FIELD WORK		
	COORDINATE DRILLING AND COMPLETION (10 HOURS PR HOLE; 11 HOLES; 110 HOURS @ $30)	$3,300
	TEMPERATURE GRADIENT LOGGING (3 HOLES PER DAY; 4 DAYS FOR ONE SURVEY; 3 SURVEYS = 12 DAYS; 12 DAYS @ 10 HOURS @ $30)	$3,600
	SUBTOTAL	$6,900
TRAVEL COSTS		
	AIRFARE: 3 R/T TRIPS DALLAS @ $300	$900
	PER DIEM: 15 DAYS @ $75	$1,125
	MILEAGE: 15 DAYS @ 250 MILES @ $0.20	$750
	SUBTOTAL	$2,775
TASK TOTAL COST		$14,775
TASK 2	GEOTHERMAL ASSESSMENT OF TEST WELL	
PURCHASED SERVICES		
	COST-SHARED GEOPHYSICAL LOGS	$2,000
	COST-SHARED PRESSURE RECOVERY TEST	$2,500
	SUBTOTAL	$4,500
FIELD WORK		
	COORDINATE DRILLING AND TESTING (40 HOURS @ $30)	$1,200
	SUPERVISE DATA COLLECTION (40 HOURS @ $30)	$1,200
	CONDUCT HYDROLOGY TEST (50 HOURS @ $30)	$1,500
	SUBTOTAL	$3,900
TRAVEL COST		
	AIRFARE: 1 R/T DALLAS; COORD W/ C.E.	$300
	PERDIEM: 2 DAYS @ $75	$150
	15 DAYS @ $25	$375
	MILEAGE: 15 DAYS @ 250 MILES @ $0.20	$750
	SUBTOTAL	$1,575
TASK TOTAL COST		$9,975
TASK 3	FINAL REPORT	
DATA EVALUATION	EVALUATE DRILL CUTTINGS, GEOPHYSICAL LOGS, WATER QUALITY ANALYSES, TEMP. DATA, AND HYDROLOGY DATA.	
FINAL REPORT	PREPARE FINAL REPORT	
	PROFESSIONAL LABOR; 220 HOURS @ $30	$6,600
	SUPPORT LABOR; 100 HOURS @ $10	$1,000
	CONSULTANT: (DR. BILL SEAGER, 40 HOURS @ $30)	$1,200
	TELEPHONE	$550
	COPYING	$100
	MAINTENANCE & REPAIRS	$100
	SUPPLIES	$100
	POSTAGE	$99
	COMPUTER	$350
	TRAVEL	
	ONE R/T DALLAS; COORD W/CORPS OF ENG	$300
	ONE TRIP SANTA FE; FINAL REPORT	$300
TASK TOTAL COST		$10,699
COST SUMMARY	TASK 1 TOTAL COST	$14,775
	TASK 2 TOTAL COST	$9,975
	TASK 3 TOTAL COST	$10,699
	SUBTOTAL	$35,449
	OVERHEAD @ 10 %	$3,545
	SUBTOTAL	$38,994
	GROSS RECEIPTS TAX @ 5.625 %	$2,193
	TOTAL ESTIMATED COST	$41,187

(7-81)

NOTICE OF FINANCIAL ASSISTANCE AWARD

(See Instructions on Reverse)

9/4/86

93-410

Under the authority of Public Law _____ and subject to legislation, regulations and policies applicable to *(cite legislative program title)*:

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE
Research on Geothermal Resources in New Mexico

2. INSTRUMENT TYPE
☒ GRANT ☐ COOPERATIVE AGREEMENT

3. RECIPIENT *(Name, address, zip code, area code and telephone no.)*
New Mexico Research and Development Inst.
1220 St.Frances Drive Room 358
Pinion Bldg. - Santa Fe, NM 87501

4. INSTRUMENT NO.
DE-FG07-84ID12546

5. AMENDMENT NO.
A002

6. BUDGET PERIOD
FROM: 9/30/86 THRU: 12/31/87

7. PROJECT PERIOD
FROM: 9/7/84 THRU: 12/31/87

8. RECIPIENT PROJECT DIRECTOR *(Name and telephone No.)*
Larry Icerman (505) 827-5886

10. TYPE OF AWARD
☐ NEW ☐ CONTINUATION ☒ RENEWAL
☐ REVISION ☐ SUPPLEMENT

9. RECIPIENT BUSINESS OFFICER *(Name and telephone No.)*
Same

12. ADMINISTERED FOR DOE BY *(Name, address, zip code, telephone No.)*
Ronald A. King (208) 526-0790
U. S. Department of Energy
Idaho Operations Office
785 DOE Place, Idaho Falls, ID 83402

11. DOE PROJECT OFFICER *(Name, address, zip code, telephone No.)*
Peggy Brookshier (208) 526-1403
DOE Idaho Operations Office
785 DOE Place, Idaho Falls, ID 83402

13. RECIPIENT TYPE
☒ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☐ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☐ C ☐ P ☐ SP ☐ OTHER *(Specify)*

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION

(1) DOE Funds Obligated This Action	$ -0-
(2) DOE Funds Authorized for Carry Over	$ 101,143
(3) DOE Funds Previously Obligated in this Budget Period	$ 109,970
(4) DOE Share of Total Approved Budget	$ 109,970
(5) Recipient Share of Total Approved Budget	$ 131,750
(6) Total Approved Budget	$ 241,720

b. CUMULATIVE DOE OBLIGATIONS

(1) This Budget Period *[Total of lines a.(1) and a.(3)]*	$ 109,970
(2) Prior Budget Periods	$ -0-
(3) Project Period to Date *[Total of lines b. (1) and b. (2)]*	$ 109,970

17. TOTAL ESTIMATED COST OF PROJECT $ _____

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations *(specify)* _____ *(Date)* _____

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☒ B (Grants) or ☐ C (Cooperative Agreements).

d. Application/proposal dated 6/8/86, ☐ as submitted ☒ with changes as negotiated

19. REMARKS This modification revises Part I - Budget Plan, some Part II conditions articles, and Part III - Statement of Work. This modification changes the original Scope of Work and extends the project period fifteen months. DOE's obligation of funds remains the same, Participants obligated share increases.

20. EVIDENCE OF RECIPIENT ACCEPTANCE

_____
(Signature of Authorized Recipient Official) *(Date)*

_____
(Name)

_____
(Title)

21. AWARDED BY

William C. Drake 9/4/86
(Signature) *(Date)*

William C. Drake
(Name)

Contracting Officer
(Title)

Part II 5. Project Period shall be revised to read:

The project completion date is December 31, 1987 which includes an additional 90 days for completion of the final report. All research efforts must be completed by September 30, 1987. Only costs associated with preparation of the final report will be allowed during the 90 days from September 30 through December 31, 1987.

Part II 6.g Invoicing Carryover Dollars shall be revised to read:

For invoicing purposes this project includes cost participation, not defined on the revised budget plan, of $83,000 of state contribution and $48,750 contributed by Lightning Dock Geothermal. It is understood that these funds will be used after the $101,143 DOE carried-over funds have been invoiced.

FEDERAL ASSISTANCE BUDGET INFORMATION FORM

FORM EIA-459C
(10/80)

FORM APPROVED
OMB No. 1900-0127

1. Program/Project Identification No.	2. Program/Project Title
DE-FG07-841D12546	Research on Geothermal Resources in New Mexico

3. Name and Address	4. Program/Project Start Date
New Mexico Research and Development Institute Pinion Bldg., Suite 358, 1220 S. St. Francis Drive Santa Fe, New Mexico 87501	9/30/86
	5. Completion Date 12/31/87

SECTION A - BUDGET SUMMARY

Grant Program, Function or Activity (a)	Federal Catalog No (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. 12546		$	$	$101,143	$ 131,750	$ 232,893
2.						
3.						
4.						
5. TOTALS		$	$	$	$	$

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	-12546 - Grant Program, Function or Activity Uncosted Federal Portion Only				Total (5)
	(1)	(2)	(3)	(4)	
a. Personnel	$ 7,330	$	$	$	$ 7,330
b. Fringe Benefits	1,393				1,393
c Travel	1,192				1,192
d. Equipment	-0-				-0-
e Supplies	585				585
f. Contractual	88,643				88,643
g. Construction	-0-				-0-
h. Other	2,000				2,000
i Total Direct Charges	101,143				101,143
j Indirect Charges	-0-				-0-
k. TOTALS	$101,143	$	$	$	$101,143
7. Program Income	$	$	$	$	$

New Mexico Research and Development Institute
(formerly New Mexico Energy Research and Development Institute)
Grant No. DE-FG07-84ID12546

STATEMENT OF WORK

1.0 Introduction

The goal of this grant modification is to support cost-shared research on geothermal resources in New Mexico. This will be accomplished through reprogramming previously allocated funds. The unspent monies were previously allocated through the State Cooperative Program for geothermal research in New Mexico. The State of New Mexico attempted to obtain an industry cost share for the funds through an RFP procedure. Although several firms responded to the RFP, none of the selected respondents were able to produce their cost share in a timely manner. Thus, the funds are available for reprogramming.

Two major research programs will be accomplished through this modification. The first is to compile and interpret all available geothermal-related data for south-central New Mexico. This will be a detailed study of the relationships between groundwater flow, heat flow, subsurface structure, and geothermal resources. The product will be a series of maps and a technical report. This effort will also be supported by the State of New Mexico. The second research program will be to perform a comprehensive hydrological survey of geothermal anomalies in the Animas Valley. This is a complex geothermal area, with shallow production separated from a possible deeper, hotter system. Cooperation with industry in this program will result in much previously proprietary data becoming public. A letter of agreement with the private sector participant is included in the proposal.

2.0 Scope

The technical objectives of this grant modification are to develop map-based syntheses of existing geoscientific data related to geothermal resources in south-central New Mexico, and to develop a detailed understanding of the inter-relationships of geothermal and irrigation groundwater systems in the Animas Valley area. The technical efforts are described in 4.0 below. Each of these tasks will be cost-shared by DOE and another other program participant. The duration of research will be two years. Final technical reports for each task will be prepared.

3.0 Applicable Documents

The effort described herein is a modification of DOE grant DE-FG07-84ID12546, as requested through letters and proposals from the New Mexico Research and Development Institute, dated May 8 and June 18, 1986. These letters and proposals commit the Research and Development Institute and Lightning Dock Geothermal to cost share in the proposed efforts.

4.0 Technical Tasks

The following tasks will be accomplished through this grant modification.

4.1 Compilation of geothermal data for south-central New Mexico

4.1.1 Compile data to prepare maps of seven different parameters. This compilation will be cost shared with the New Mexico Research and Development Institute. The tasks are:

a. Compile a location map and list of data sources

b. Compile all existing heat flow data

c. Compile temperature gradient data from all available holes

d. Compile tectonic and geologic data, to develop a geologic map including Teriary subcrops, pre-Tertiary lithology distribution and geologic structures. Where appropriate, other Tertiary and younger geologic features relevant to geothermal resources, such as volcanic vents, should also be indicated.

e. Compile water table elevations, to indicate groundwater flow regimes, such as zones of recharge, discharge, and flow constriction

f. Compile depths to water table

g. Compile locations of site-specific studies

No original data will be collected; only data available from previous studies will be used. The maps will be compiled at a scale of at least 1:500,000; these will be reduced to 8 1/2 by 11 inch page size for the final report. The larger maps will be made available to interested researchers through open-file or other appropriate procedures.

4.1.2 Final Report

A final report, described under 5.2.1, will be prepared as part of this task.

4.2 Geothermal Reservoir hydrology of the Animas Valley

4.2.1 The following five tasks will be accomplished in the area of geothermal anomalies in the Animas Valley. These efforts will be cost shared with Lightning Dock Geothermal.

a. Review and evaluate existing hydrologic data.

Include all data and reports available in the public domain, and previously proprietary data being made available through this study. These data include detailed water chemistry, temperature surveys, or hydrographic data from about 60 irrigation wells, and

previously proprietary water chemistry and temperature surveys from 12 shallow geothermal wells. Reinterpret all data, including data from well 55-7. Evaluate these data to determine, to the extent possible, drawdown due to geothermal fluid extraction and the potential for communication between geothermal and irrigation wells. Systematically evaluate the temperature, mineral content, and water level for the 72 wells.

b. Field work.

Select nine irrigation and three geothermal wells from those identified above for detailed study. The basis of selection will be a distribution to assure areal coverage and currently existing data. Measure temperatures and water chemistry for the wells at least monthly. Interpret the results of these measurements in terms of irrigation, precipitation, and geothermal use patterns during all four seasons.

c. Water quality analyses

A total of 27 chemical analyses of major and trace elements significant for interpretation of geothermal resources will be obtained. The initial analyses will be for 9 irrigation and geothermal wells. Two irrigation and three geothermal wells will be sampled and analyzed during the subsequent three climatic seasons. These data will be compared and analyzed in the context of the existing proprietary data base that contains more than 60 complete chemical analyses.

d. Temperature surveys

A precision down-hole temperature survey will be made of the 12 accessible geothermal wells on a monthly basis.

e. Hydrographic surveys

For at least two irrigation wells and two geothermal wells, obtain precision drawdown measurements on at least a monthly basis. Where accessible, measure water levels in other irrigation or geothermal wells.

4.2.2 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task.

5.0 Reports, Data, and Other Deliverables

5.1 Management records

Reports will be due as indicated on the Federal Assistance Reporting Checklist and the Report Distribution List.

5.2 Final technical reports

5.2.1a Final report, south-central New Mexico

A detailed final technical report will be prepared. The report will describe all data tables, maps, methods of research and data reduction. The report will also analyze and discuss interpretations of heat-flow, tectonic, and groundwater flow information. Various models of geothermal resources derived from site-specific studies will be analyzed within a regional framework. The report will include a complete bibliography of data sources and references.

5.2.1b Final report, Animas Valley

Prepare a final technical report on the project. This report will describe all data tables, charts, methods of research and data reduction. The report will also discuss interpretations of the hydrological information. A complete bibliography of data sources and references will be included. All proprietary data made available by Lightning Dock Geothermal to this project, including but not limited to data from well 55-7, thermal measurements, water chemical analyses, and other appropriate geologic and hydrologic data, will be made available to the public as part of the final report.

5.2.2 The final reports for each task may be produced and published in one volume, in conjunction with other appropriate documents.

6.0 Special Considerations

Successful completion of the technical tasks described above is contingent upon DOE cost-sharing these efforts with other program participants. For the study of south-central New Mexico, the New Mexico Research and Development Institute will provide additional funding. For the study of the Animas Valley, additional funding will be provided by Lightning Dock Geothermal, through an agreement with the New Mexico Research and Development Institute. Centralized management and project reporting for this program will be through the New Mexico Research and Development Institute.

(See Instructions on Reverse)

Under the authority of Public Law 93-410 subject to legislation, regulations and policies applicable to (cite legislative program title):

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE
Geothermal Exploration Well at New Mexico State University

2. INSTRUMENT TYPE
☒ GRANT ☐ COOPERATIVE AGREEMENT

3. RECIPIENT (Name, address, zip code, area code and telephone no.)
New Mexico Energy Research & Dev. Int.
1220 St. Francis Drive Room 358
Pinon Bldg. - Santa Fe, NM 87501

4. INSTRUMENT NO.
DE-FG07-84ID12546

5. AMENDMENT NO.
M001

6. BUDGET PERIOD
FROM: 9/30/85 THRU: 9/30/86

7. PROJECT PERIOD
FROM: 9/7/84 THRU: 9/30/8

8. RECIPIENT PROJECT DIRECTOR (Name and telephone No.)
Larry Icerman (505) 827-5886

10. TYPE OF AWARD
☐ NEW ☐ CONTINUATION ☐ RENEWAL
☐ REVISION ☒ SUPPLEMENT

9. RECIPIENT BUSINESS OFFICER (Name and telephone No.)

12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone No.)
Ronald A. King (208) 526-0790
U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

11. DOE PROJECT OFFICER (Name, address, zip code, telephone No.)
Peggy A. M. Brookshier
Department of Energy
785 DOE Place, Idaho Falls, ID 83402

13. RECIPIENT TYPE
☒ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☐ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☐ C ☐ P ☐ SP ☐ OTHER (Specify)

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number
89X0224.91	AM1510000	ID-54-91/250	

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION

(1) DOE Funds Obligated This Action	$ 19,970
(2) DOE Funds Authorized for Carry Over	$ 90,000
(3) DOE Funds Previously Obligated in this Budget Period	$ 90,000
(4) DOE Share of Total Approved Budget	$ 109,970
(5) Recipient Share of Total Approved Budget	$ 53,000
(6) Total Approved Budget	$ 162,970

b. CUMULATIVE DOE OBLIGATIONS

(1) This Budget Period [Total of lines a.(1) and a.(3)]	$ 109,970
(2) Prior Budget Periods	$
(3) Project Period to Date [Total of lines b. (1) and b. (2)]	$ 109,970

17. TOTAL ESTIMATED COST OF PROJECT $

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations (specify) N/A (Date)

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☒ B (Grants) or ☐ C (Cooperative Agreements).

d. Application/proposal dated 6/85, ☐ as submitted ☒ with changes as negotiated

19. REMARKS This modification revises Part I - Budget Plan, Part II - 5. Payments, and Part III - Statement of Work, and Reporting Requirements. This modification changes tasking, within Scope, to the Statement of Work. Six months extension and additional funds increase total Project costs to $109,970. DOE Project Officer and Contract Adminstrator are also changed

20. EVIDENCE OF RECIPIENT ACCEPTANCE

Larry Icerman 9/27/85
(Signature of Authorized Recipient Official) (Date)

Larry Icerman
(Name)

Director
(Title)

21. AWARDED BY

William C. Drake 9/26/85
(Signature) (Date)

William C. Drake
(Name)

Contracting Officer
(Title)

GRANTEE: STATE OF NEW MEXICO

BUDGET PLAN

Item	FY85 Carryover	FY86
Salaries	$ 7,139	$10,421
Fringe Benefits	1,356	4,334
Travel	1,580	250
Other	2,425	250
Subcontracts	47,500	-0-
(Contingency)	30,000	-0-
Supplies	-0-	350
Report Preparation	-0-	500
Indirect Costs	-0-	3,865
Total	$90,000	$19,970

It is further agreed that previously obligated, unspent funds, designated on the original FY85 budget plan as subcontract dollars, will be set aside as a contingency fund not to exceed $30,000. These funds will be used only for equipement lost down the well hole but will not be used until the $50,000 New Mexico State University cost-share funds have been spent. In addition, these contingency funds will only be used below the 974 foot level, excluding normal drilling activities.

Add to Article 6. Payments:

6. g. Invoicing FY85 Carryover dollars

For invoicing purposes this project includes cost paritipation, not shown on the revised budget plan, of $50,000 contributed by New Mexico State University. It is understood that these funds will be used for Contractual Programs after the $47,500 DOE FY85 budgeted funds have been invoiced. Additionally, another $3,000 contribution, not shown on the budget plan, was made by the State of New Mexico for Report Preparation.

STATEMENT OF WORK
NEW MEXICO ENERGY RESEARCH AND DEVELOPMENT INSTITUTE/ NEW MEXICO STATE UNIVERSITY

The purpose of this program is to identify the geologic nature of seismic reflection lines, and test, if possible, the geothermal reservoir beneath New Mexico State University. This will be accomplished by deepening existing well DT-3 on the New Mexico State University campus from 974 feet to a target depth of 1500 feet. Drilling associated costs of up to $50,000 will be paid by NMSU. Well completion is not part of this program.

Task 1. Prepare invitations for bids from well drillers. Solicit bids, evaluate responses, and select most responsive bidder. Obtain necessary permits.

Task 2. Refine the well plan with the selected driller, to optimize drilling methods and probability of reaching target depth.

Task 3. Conduct well drilling program to deepen the well. Collect drill cuttings at 10 foot intervals.

Task 4. Acquire an appropriate suite of geophysical logs, including temperature and other geophysical and electrical logs. Spinner log, acoustic log, or other logs may also be acquired.

Task 5. If fluids are encountered, conduct a limited duration air lift test to acquire samples for water quality analysis and data for hydrologic assessment. Obtain water analyses.

Task 6. Prepare a final technical report using data from all phases of prior surface geophysical work, well drilling, and reservoir definition work. Include copies and a discussion of the geophysical and lithologic logs, results of the water analyses, and other relevant data. Develop an integrated model of the geothermal reservoir beneath the NMSU campus and adjacent areas. Curate and store cuttings in an appropriate manner.

Task 7. Provide overall project management and complete and report on tasks in a timely manner. Management reports shall be provided as defined by the attached DOE Form EIA 459A - Reporting Requirements Checklist. The required reports are also summarized as follows:

	REPORT	DUE
(1)	Form DOE 538 Notice of Energy RD&D	30 days after award of grant
(2)	Quarterly Management Summary Report	15 days after calendar quarter end
(3)	Project Status Report	15 days after calendar quarter end
(4)	Final Report (Draft)	Due 45 days prior to completion date
(5)	Final report	Due on completion date
(6)	Financial Status Report - OMB Form 269	Due annually and upon completion

The deliverables resulting from the tasks outlined above which will be delivered to DOE are summarized as follows:

1. The Final report--one camera-ready copy plus twelve additional copies--will be distributed as specified in the attached DOE Form EIA 459A.

2. Reports previously described under Task 5 above will be prepared and issued in the amounts and at the frequency shown.

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA-459A (10/80)

FORM APPROVED OMB NO. 1900-0127

1. Identification Number: DE-FG07-84ID12546	2. Program/Project Title: Geothermal Exploration Well

3. Recipient: New Mexico Energy Research & Development Institute

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
☐ Federal Assistance Milestone Plan			
☐ Federal Assistance Budget Information Form			
☒ Federal Assistance Management Summary Report	Q	1,1,1	A,B,C
☒ Federal Assistance Program/Project Status Report	Q	1,1,1	A,B,D
☒ Financial Status Report, OMB Form 269	Y,F	1,1	A,C
TECHNICAL INFORMATION REPORTING			
☒ Notice of Energy RD&D	Y	1,1,1	A,B,E
☐ Technical Progress Report			
☒ Topical Report	A*	1,1,1	A,B,D
☒ Final Technical Report	F*	1,1,1	A,B,D

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final; 90 calendar days after the performance of the effort ends.
Q - Quarterly; within 30 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

*Draft copy due 45 days prior to completion date.
One camera-ready copy must be included

6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)
	Ronald A. Kuig 9/25/85

REPORT DISTRIBUTION LIST

DE-FG07-84ID12546

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho FAlls, ID 83402

A ATTN: Peggy Brookshier, Program Manager
Energy & Technology Division

B ATTN: Ronald A. King
Contracts Management Division

C ATTN: E. G. Jones, Director
Financial Management Division

D University of Utah Research Insitute
Earth Science Laboratory
391 Chipeta Way, Suite A
Salt Lake City, UT 84108
ATTN: Duncan Foley

E U. S. Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

DOE F 4600.1
(7-81)

U.S. DEPARTMENT OF ENERGY

NOTICE OF FINANCIAL ASSISTANCE AWARD

(See Instructions on Reverse)

Under the authority of Public Law 93-40 and subject to legislation, regulations and policies applicable to *(cite legislative program title)*:
Geothermal Research, Development, and Demonstration Act of 1977

1. PROJECT TITLE
New Mexico Statewide Geothermal Energy Program

2. INSTRUMENT TYPE
☒ GRANT ☐ COOPERATIVE AGREEMENT

3. RECIPIENT *(Name, address, zip code, area code and telephone no.)*
New Mexico Energy Research & Devl. Inst.,1220 ST. Francis Dr., Rm. 358 Pinon Bldg.
Santa Fe, New Mexico 87501

4. INSTRUMENT NO.
DE-FG07-84ID12546

5. AMENDMENT NO.
ORIG.

6. BUDGET PERIOD
FROM: 9/7/84 THRU: 3/7/86

7. PROJECT PERIOD
FROM: 9/7/84 THRU: 3/7/86

8. RECIPIENT PROJECT DIRECTOR *(Name and telephone No.)*
Larry Icerman (505)827-5886

9. RECIPIENT BUSINESS OFFICER *(Name and telephone No.)*

10. TYPE OF AWARD
☒ NEW ☐ CONTINUATION ☐ RENEWAL
☐ REVISION ☐ SUPPLEMENT

11. DOE PROJECT OFFICER *(Name, address, zip code, telephone No.)*
R. Eldon Bray, DOE-ID (208)526-0086
U. S. Department of Energy Idaho Operations
550 Second Street Idaho Falls, ID 83401

12. ADMINISTERED FOR DOE BY *(Name, address, zip code, telephone No.)*
E. M. Hyster, DOE-ID (208)526-1229
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

13. RECIPIENT TYPE
☒ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☐ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☐ C ☐ P ☐ SP ☐ OTHER *(Specify)*

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number
89x0224.91	AM1510000	ID-44-91/250	

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION		b. CUMULATIVE DOE OBLIGATIONS	
(1) DOE Funds Obligated This Action	$ 90,000	(1) This Budget Period *[Total of lines a.(1) and a.(3)]*	$ 90,000.00 -0-
(2) DOE Funds Authorized for Carry Over	$ -0-	(2) Prior Budget Periods	$
(3) DOE Funds Previously Obligated in this Budget Period	$ -0-		
(4) DOE Share of Total Approved Budget	$ 90,000		
(5) Recipient Share of Total Approved Budget	$ -0-	(3) Project Period to Date *[Total of lines b. (1) and b. (2)]*	$ 90,000.00
(6) Total Approved Budget	$ 90,000		

17. TOTAL ESTIMATED COST OF PROJECT $

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations *(specify)* N/A *(Date)*

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☐ B (Grants) or ☐ C (Cooperative Agreements).

d. Application/proposal dated May 1984, ☐ as submitted ☒ with changes as negotiated

19. REMARKS

This Grant consists of this NFAA, Part I-Budget Plan, Part II -Conditions, Part III-Statement of work. The DOE Financial Assistance Rules (10 CFR Part 600), OMB Circular A-102, and OMB Circular A-87, are incorporated by reference and attached hereto.

20. EVIDENCE OF RECIPIENT ACCEPTANCE

Larry Icerman 9/17/84
(Signature of Authorized Recipient Official) *(Date)*
Larry Icerman
(Name)
Director
(Title)

21. AWARDED BY

William C. Drake 9/7/84
(Signature) *(Date)*
William C. Drake
(Name)
Contracting Officer
(Title)

Grant No. DE-FG07-84ID12546
Part I - Budget Plan
Page 1 of 1

GRANTEE: State of New Mexico

BUDGET PLAN

Salaries	$ 7,139
Fringe Benefits	1,356
Travel	1,580
Supplies	425
Publications	2,000
Subcontracts:	
Electrical Grade Reservoir Definition	30,000
Moderate to Intermediate Temperature Reservoir Characterization	30,000
Temperature Gradient Drilling	17,500
TOTAL	$90,000

No Overhead will be charged to this grant by the State of New Mexico.

STATEMENT OF WORK

Grantee: NEW MEXICO ENERGY RESEARCH AND DEVELOPMENT INSTITUTE

The Grantee will accomplish the following tasks:

Task 1. Develop requests for proposals (RFP's) in each of the three subject areas the drilling will be focused on, issue a statewide call for proposals, evaluate the proposals, determine the awards, and make the awards.

Task 2. Administer and monitor all contracts developed under the proposal.

Task 3. Prepare a comprehensive final technical report describing in detail the results of all three drilling programs.

Task 4. Provide overall project management and complete and report on tasks in a timely manner. Management reports shall be provided as defined by the attached DOE Form EIA 459A Reporting Requirements Checklist. The required reports are also summarized as follows:

	Due
Form DOE 538 Notice of Energy RD&D	30 days after award of grant
Quarterly Management Summary Report	15 days after calendar quarter end
Project Status Report	15 days after calendar quarter end
Final Report (Draft)	45 days prior to completion date
Final Report	On completion date
Financial Status Report OMB Form 269	On completion date

The deliverables resulting from the tasks outlined above which will be delivered to DOE are summarized as follows:

1. The Final Report - one camera-ready plus sixteen additional copies as detailed in Task 3 above will be distributed as specified in the attached DOE Form EIA 459A.

2. Reports previously described under Task 4 above will be prepared and issued in the amounts and at the frequency shown.

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA 459A
(10/80)

FORM APPROVED
OMB NO 1900-0127

1. Identification Number: DE-FG07-84ID12546

2. Program/Project Title: Geothermal

3. Recipient:

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
☐ Federal Assistance Milestone Plan			
☐ Federal Assistance Budget Information Form			
☒ Federal Assistance Management Summary Report	Q		
☒ Federal Assistance Program/Project Status Report	Q		
☒ Financial Status Report, OMB Form 269	Y, F		
TECHNICAL INFORMATION REPORTING			
☒ Notice of Energy RD&D	O		
☐ Technical Progress Report			
☐ Topical Report			
☒ Final Technical Report	F		

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final, at end of project period.
Q - Quarterly; within 30 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

6. Prepared by: (Signature and Date)

7. Reviewed by: (Signature and Date)

U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
REPORT DISTRIBUTION LIST

Grant No.
DE-FG07-84ID12546

Addressees	Federal Assistance Milestone Plan	Federal Assistance Budget Information Form	Federal Assistance Program/Project Status Report	Federal Assistance Management Summary Report	Financial Status Report, OMB Form 269	Notice of Energy RD&D Technical Progress Report	Topical Report	Final Technical Report
	Number of Report Copies							
U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, ID 83401								
Attn: R. Eldon Bray, Program Mgr. Energy & Technology Division			2	2				8
Attn: Elizabeth M. Hyster Contracts Management Div.			1	1	1	1		1
Attn: E. G. Jones, Director Financial Management Div.			1					
U. S. Department of Energy Forrestal Bldg., CE-324 1000 Independence Ave, S.W. Washington, DC 20585 Attn: Ron Toms			1	1				6
University of Utah Research Institute Earth Science Laboratory 391 Chipeta Way, Suite C Salt Lake City, UT 84108 Attn: Duncan Foley			1	1				1
U. S. Department of Energy Technical Information Center P. O. Box 62 Oak Ridge, TN 37830					1			

Special Instructions

PART II - CONDITIONS

This grant is subject to the following provisions:

1. General

The grantee is obligated to conduct such project oversight as may be appropriate, to manage the funds with prudence, and to comply with the provisions outlined herein.

2. Reporting Program Technical Performance

a. Copies. Copies of reports and all other related data and information generated under this grant shall be submitted in accordance with the attached Federal Assistance Reporting Checklist (DOE Form EIA-459A).

b. Publication of results. The grantee may publish the results of its work. However, publications and reports prepared under this grant shall contain the following acknowledgment statement, "This (material) was prepared with the support of the U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12546. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE."

c. The Federal assistance recipient shall prepare and submit (postage prepaid) the plans and reports indicated on the Federal Assistance Reporting Distribution List. Preparation of the specified plans and reports shall be in accordance with the DOE Order 1332.2. The level of detail the recipient provides in the plans and reports shall be commensurate with the scope and complexity of the task and shall be as delineated in Block 4 - Reporting Requirements - and Block 5 - Special Instructions. The prime recipient shall be responsible for acquiring data from any subcontractors, or subrecipients to ensure that data submitted are compatible with the data elements which prime recipients submit to DOE. Plans and reports submitted in compliance with this provision are in addition to any other reporting requirements of the Federal assistance instrument.

d. All reports delivered to DOE shall be the sole property of the DOE. The grantee shall not claim that any report contains any trade secrets or commercial or financial information deemed by the grantee to be privileged or confidential, or that the grantee has any proprietary interest in any report.

3. Travel

Domestic travel is an appropriate charge to this grant, and prior authorization for specific trips is not required. Foreign travel must be clearly essential to the grant effort and must, to be charged against this grant, have prior explicit approval of the Contracting Officer regardless of its inclusion in the approved grant budget. The grantee agrees to use U.S. Flag air carriers to the maximum extent practicable when international air transportation becomes necessary under this grant. The difference in cost between first-class air accommodations and economy class accommodations is unallowable.

4. Allowable Costs

Allowability of costs shall be determined in accordance with OMB Circular A-87 which is attached and hereby incorporated by reference.

5. Project Period

The project completion date is March 7, 1986, which includes an additional 90 days for completion of the final report. All research effort must be completed by December 7, 1985. Only costs associated with preparation of the final report will be allowed during the 90 days from December 7, 1985 through March 7, 1986.

6. Payments

a. The grantee may request advance payment of cost to be incurred. Such requests should not exceed the expected outlays by the grantee in the succeeding 30-day period.

b. Payments to the grantee shall equal the Federal share of actual allowable costs of performance of this grant, provided however, and notwithstanding any other provision of this grant, that the Government's monetary liability under this grant shall not exceed the Government share of the total approved budget or an amount equal to the Federal share of actual allowable costs, whichever is less. The grantee shall be obligated to perform under this grant throughout the agreed-upon period of performance, and to bear all costs which DOE has not agreed to pay. However, the grantee shall have the right to cease to perform when or after the Federal share of actual allowable costs equals or exceeds the Government share of the total approved budget and if prior written notice to that has been provided to DOE.

c. The Government obligations may be increased unilaterally by DOE by written notice to the grantee and may be increased or decreased by written agreement of the parties.

6. Payments (Cont'd)

d. Upon termination or expiration of the total period of performance, the grantee shall promptly refund to DOE (or make such disposition as DOE may in writing direct) any sums paid by DOE to the grantee under this grant in excess of the cumulative Government allowable cost incurred in performance under the grant.

e. Applicable Credits. The grantee agrees that any refunds, rebates, credits, or other amounts (including any interest thereon) accruing to or received by the grantee or any assignee under this grant shall be paid by the grantee to the Government, to the extent that they are properly allocable to costs for which the grantee has been reimbursed by the Government under this grant. Reasonable expenses incurred by the grantee for the purpose of securing such refunds, rebates, credits, or other amounts shall be allowable costs hereunder when approved by the Contracting Officer.

f. Audit Adjustments. The Contracting Officer may have invoices or vouchers and statements of cost submitted under this grant audited at any time prior to the end of the required retention period for the grant records. Each payment made shall be subject to reduction for amounts included in the related invoice or voucher which are found by the Contracting Officer, on the basis of audit, not to constitute allowable cost. If a final audit of costs has not been performed prior to closeout of the grant, DOE or its successor agency, shall have the right to recover an appropriate amount after fully considering the recommendations on disallowed costs resulting from the final audit when conducted.

7. Financial Reporting Requirements

Three copies of the grantee's Financial Status Report (prepared on an accrual basis) shall be submitted to the Contracting Officer at the end of the project period. (The project period of this grant is inclusive of the 90 days stated in OMB Circular A-102, Attachment H.)

8. Retention and Custodial Requirements for Records

Grantees shall retain and permit examination of records as required by OMB Circular A-102, Attachment C.

9. Patent Rights - Short Form

(a) Definitions.

(1) "Subject Invention" means any invention or discovery of the grantee conceived or first actually reduced to practice in the course of or under this grant and includes any art, method, process, machine,

9. Patent Rights - Short Form (Cont'd)

manufacture, design, or composition of matter, or any new and useful improvement thereof, or any variety of plants, whether patented or unpatented, under the patent laws of the United States of America or any foreign country.

(2) "Patent Counsel" means DOE Patent Counsel assisting the procuring activity.

(b) Invention disclosures and reports.

(1) The grantee shall furnish the Patent Counsel (with notification by Patent Counsel to the Contracting Officer):

(i) A written report containing full and complete technical information concerning each subject invention within 6 months after conception or first actual reduction to practice but in any event prior to any sale, public use, or public disclosure of such invention known to the grantee. The report shall identify the Grant and inventor and shall be sufficiently complete in technical detail and appropriately illustrated by sketch or diagram to convey to one skilled in the art to which the invention pertains, a clear understanding of the nature, purpose, operation and, to the extent known, the physical, chemical, biological or electrical characteristics of the invention;

(ii) Upon request, but not more than annually, interim reports on a DOE-approved form listing subject inventions for that period and certifying that all subject inventions have been disclosed or that there were no such inventions; and

(iii) A final report on a DOE-approved form within 3 months after completion of the Grant work listing all subject inventions and certifying that all subject inventions have been disclosed or that there were no such inventions.

(2) The grantee agrees that the Government may duplicate and disclose subject invention disclosures and all other reports and papers furnished or required to be furnished pursuant to the Grant.

(c) Allocation of principal rights.

(1) Assignment to the Government. The grantee agrees to assign to the Government the entire right, title, and interest throughout the world in and to each subject invention, except to the extent that rights are retained by the grantee under paragraphs (c)(2) and (d) of this clause.

9. Patent Rights - Short Form (Cont'd)

(2) Greater rights determination. The grantee, or the employee-inventor with authorization of the grantee, may request greater rights than the nonexclusive license and the foreign patent rights provided in paragraph(d) of this clause on identified inventions in accordance with the procedure and criteria of 41 CFR 9-9.109-6. A request for a determination of whether the grantee or the employee-inventor is entitled to retain such greater rights must be submitted to the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) at the time of the first disclosure of the invention pursuant to subparagraph (b)(1) of this clause or not later than 9 months after conception or first actual reduction to practice, whichever occurs first, or such longer period as may be authorized by the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) for good cause shown in writing by the grantee. The information to be submitted for greater rights determination is specified in 41 CFR 9-9.109-6(e).

(d) Minimum rights to the grantee. The grantee reserves a revocable, nonexclusive, paid-up license in each patent application filed in any country on a subject invention and any resulting patent in which the Government acquires title. Revocation shall be in accordance with the procedures of paragraphs (c)(2) and (3) of the clause in 41 CFR 9-9.107-5(a). The grantee also has the right to request foreign rights in accordance with the procedures of paragraph (c)(4) of the clause in 41 CFR 9-9.107-5(a).

(e) Employee and contractor or subgrantee agreements. Unless otherwise authorized in writing by the Contracting Officer, the grantee shall:

(1) Obtain patent agreements to effectuate the provisions of the Patent clause from all persons who perform any part of the work under this grant except nontechnical personnel, such as clerical employees and manual laborers.

(2) The grantee shall include this clause or the Patent Rights clause of 41 CFR 9-9.107-5(a) or the clause of 600.118(b)(1), as appropriate, modified to identify the parties in any contract or subgrant hereunder having as a purpose the conduct of experimental, research, development, or demonstration work; and

(3) Promptly notify the Contracting Officer in writing upon the award of any contract or subgrant containing a Patent Rights clause by identifying the contractor or subgrantee, the work to be performed under the contract or subgrantee, and the dates of award and estimated completion. Upon the request of the Contracting Officer, the grantee shall furnish a copy of the contract or subgrant to such requestor.

9. Patent Rights - Short Form (Cont'd)

(f) Atomic energy.

(1) No claim for pecuniary award or compensation under the provisions of the Atomic Energy Act of 1954, as amended, shall be asserted by the grantee or its employees with respect to any inventions or discovery made or conceived in the course of or under this Grant.

(2) Except as otherwise authorized in writing by the Contracting Officer, the grantee will obtain patent agreements to effectuate the provisions of paragraph(f)(1) of the clause from all persons who perform any part of the work under this Grant, except nontechnical personnel, such as clerical employees and manual laborers.

G. Publication. In order that information concerning scientific or technical developments conceived or first actually reduced to practice in the course of or under the Grant is not prematurely published so as to adversely affect patent interest of DOE, the grantee agrees to submit to the Patent Counsel for patent review a copy of each paper 60 days prior to its intended publication date. The grantee may publish such information after expiration of a 60-day period following such submission or prior thereto if specifically approved by the Patent Counsel, unless the grantee is informed (in writing within the 60-day period) that in order to protect patentable subject matter, publication must further be delayed. In this event, publication shall be delayed up to 100 days beyond the 60-day period or such longer period as mutually agreed to.

10. Rights in Technical Data - Short Form

(a) Definitions. The definitions of terms set forth in 41 CFR 9-9.201 apply to the extent these terms are used herein.

(b) Allocation of rights.

(1) The Government shall have:

(i) Unlimited rights in technical data first produced or specifically used in the performance of this grant.

(ii) The right of the Contracting Officer or his representatives to inspect at all reasonable times up to three years after final payment under this grant all technical data first produced or specifically used in the grant (for which inspection the grantee or its contractor or subgrantee shall afford proper facilities to DOE); and

10. Rights in Technical Data - Short Form (Cont'd)

(2) The grantee agrees that it will not knowingly include any material copyrighted by others in any written or copyrightable material furnished or delivered under this grant without a license as provided for in subparagraph (1)(ii) hereof, or without the consent of the copyright owner, unless it obtains specific written approval of the Contracting Officer for the inclusion of such copyrighted material.

11. Authorization and Consent

The Government hereby gives its authorization and consent for all use and manufacture of any invention described in and covered by a patent of the United States in the performance of this grant or any part hereof or any amendment hereto or any contract hereunder (including any lower-tier subcontracts).

12. Notice and Assistance Regarding Patent and Copyright Infringement

The provisions of this clause shall be applicable only if the amount of this grant exceeds $10,000.

(a) The grantee shall report to the Contracting Officer, promptly and in reasonable written detail, each notice of claim of patent or copyright infringement based on the performance of this grant of which the grantee has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this grant or out of the use of any supplies furnished or work or services performed hereunder, the grantee shall furnish to the Government when requested by the Contracting Officer, all evidence and information in possession of the grantee pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the grantee has agreed to indemnify the Government.

c. This clause shall be included in all contracts and subgrants under the grant.

13. Reporting of Royalties

If this grant is in an amount which exceeds $10,000 and if any royalty payments are directly involved in the grant or are reflected in the amount of the grant award, the grantee agrees to report in writing to the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) during the performance of this grant and prior to its completion or closeout, the amount of any royalties or other payments paid or to be

13. Reporting of Royalties (Cont'd)

paid by it directly to others in connection with the performance of this grant together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit the identification of the patents or other basis on which the royalties are to be paid. The approval of DOE of any individual payments or royalties shall not stop the Government at any time from contesting the enforceability, validity, or scope of, or title to, any patent under which a royalty or payments are made.

14. Procurement Standards

grantee procurements are subject to the requirements of OMB Circular A-102, Attachment O. DOE prior approval is required for all sole source contracts or where only one bid or proposal is received and the aggregate expenditure is expected to exceed $10,000.

15. Revision of Financial Plans

Any revision to financial plans under this grant are subject to the requirements of OMB Circular A-102, Attachment K and paragraph 600.114 of the DOE Financial Assistance Rules (10 CFR Part 600). DOE approval is required for transfers of amounts budgeted between direct and indirect costs. Among direct cost catagories, DOE approval is required when the cumulative amounts of such transfers exceeds or is expected to exceed 5% of the total budget as last approved by DOE. The grantee shall promptly notify DOE whenever the amount of Federal authorized funds is expected to exceed the needs of the recipient by more than $5,000 or five percent of the Federal award, whichever is greater. None of the substantive programmatic work may be subcontracted or transferred without the prior approval of DOE.

16. Program Income

Program income is subject to the policy prescribed by OMB Circular A-102, Attachment E and paragraph 600.113 of the DOE Financial Assistance Rules (10 CFR Part 600). Program income other than interest, proceeds from the sale of real and personal property, and royalties shall be treated as specified in 600.113(e)(2)(i). That is they shall be deducted from the total approved budget to determine the net costs on which the DOE costs shall be calculated.

17. Liabilities and Losses

DOE assumes no liability with respect to any damages or loss arising out of any activities undertaken with the financial support of this grant.

18. Property

Property is subject to the requirements of OMB Circular A-102, Attachment N and paragraph 600.117 of the DOE Financial Assistance Rules (10 CFR Part 600). At the end of the project period or at the termination of DOE support for the project, the grantee shall certify as to any property acquired under this grant.

19. Suspension and Termination

a. DOE reserves the right to suspend this grant in accordance with the provisions of OMB Circular A-102, Attachment L, paragraph 4 and paragraph 600.122 of the DOE Financial Assistance Rules (10 CFR Part 600).

b. DOE reserves the right to terminate for cause, in addition to the right to terminate for convenience as provided in OMB Circular A-102, Attachment L, paragraph 5 and paragraph 600.122 of the DOE Financial Assistance Rules (10 CFR Part 600).

NEW MEXICO

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2	6,752.54	15,581.30		94,388.70		7/31/86	@ID 10/14/86		@ESL 10/17/86	
3	5,143.70	20,725.00		89,245.00		4/30/87	subcontract only. @ID 6/1/87		@ESL 6/15/87	
4	46,823.47	67,548.47		42,421.53		10/08/87	@ID 10/8/87		@ESL 10/9/87	
5	38,061.40	105,609.87		4,360.13						
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as mailed to DOE
Aug. 13, 1986

New Mexico Research and Development Institute
(formerly New Mexico Energy Research and Development Institute)
Suggested Scope of Work and Statement of Work
August ~~X~~ 13, 1986

STATEMENT OF WORK

1.0 Introduction

The goal of this grant modification is to support cost-shared research on geothermal resources in New Mexico. This will be accomplished through reprogramming previously allocated funds. The unspent monies were previously allocated through the State Cooperative Program for geothermal research in New Mexico. The State of New Mexico attempted to obtain an industry cost share for the funds through an RFP procedure. Although several firms responded to the RFP, none of the selected respondents were able to produce their cost share in a timely manner. Thus, the funds are available for reprogramming.

Two major research programs will be accomplished through this modification. The first is to compile and interpret all available geothermal-related data for south-central New Mexico. This will be a detailed study of the relationships between groundwater flow, heat flow, subsurface structure, and geothermal resources. The product will be a series of maps and a technical report. This effort will also be supported by the State of New Mexico. The second research program will be to perform a comprehensive hydrological survey of geothermal anomalies in the Animas Valley. This is a complex geothermal area, with shallow production separated from a possible deeper, hotter system. Cooperation with industry in this program will result in much previously proprietary data becoming public. A letter of agreement with the private sector participant is included in the proposal.

2.0 Scope

The technical objectives of this grant modification are to develop map-based syntheses of existing geoscientific data related to geothermal resources in south-central New Mexico, and to develop a detailed understanding of the inter-relationships of geothermal and irrigation groundwater systems in the Animas Valley area. The technical efforts are described in 4.0 below. Each of these tasks will be cost-shared by DOE and another ~~other~~ program participant. The duration of research will be two years. Final technical reports for each task will be prepared.

3.0 Applicable Documents

The effort described herein is a modification of DOE grant DE-FG07-84ID12546, as requested through letters and proposals from the New Mexico Research and Development Institute, dated May 8 and June 18, 1986. These letters and proposals commit the Research and Development Institute and Lightning Dock Geothermal to cost share in the proposed efforts.

4.0 Technical Tasks

The following tasks will be accomplished through this grant modification.

4.1 Compilation of geothermal data for south-central New Mexico

4.1.1 Compile data to prepare maps of seven different parameters. This compilation will be cost shared with the New Mexico Research and Development Institute. The tasks are:

a. Compile a location map and list of data sources

b. Compile all existing heat flow data

c. Compile temperature gradient data from all available holes

d. Compile tectonic and geologic data, to develop a geologic map including Teriary subcrops, pre-Tertiary lithology distribution and geologic structures. Where appropriate, other Tertiary and younger geologic features relevant to geothermal resources, such as volcanic vents, should also be indicated.

e. Compile water table elevations, to indicate groundwater flow regimes, such as zones of recharge, discharge, and flow constriction

f. Compile depths to water table

g. Compile locations of site-specific studies

No original data will be collected; only data available from previous studies will be used. The maps will be compiled at a scale of at least 1:500,000; these will be reduced to 8 1/2 by 11 inch page size for the final report. The larger maps will be made available to interested researchers through open-file or other appropriate procedures.

4.1.2 Final Report

A final report, described under 5.2.1, will be prepared as part of this task.

4.2 Geothermal Reservoir hydrology of the Animas Valley

4.2.1 The following five tasks will be accomplished in the area of geothermal anomalies in the Animas Valley. These efforts will be cost shared with Lightning Dock Geothermal.

a. Review and evaluate existing hydrologic data.

Include all data and reports available in the public domain, and previously proprietary data being made available through this study. These data include detailed water chemistry, temperature surveys, or hydrographic data from about 60 irrigation wells, and

previously proprietary water chemistry and temperature surveys from 12 shallow geothermal wells. Reinterpret all data, including data from well 55-7. Evaluate these data to determine, to the extent possible, drawdown due to geothermal fluid extraction and the potential for communication between geothermal and irrigation wells. Systematically evaluate the temperature, mineral content, and water level for the 72 wells.

b. Field work.

Select nine irrigation and three geothermal wells from those identified above for detailed study. The basis of selection will be a distribution to assure areal coverage and currently existing data. Measure temperatures and water chemistry for the wells at least monthly. Interpret the results of these measurements in terms of irrigation, precipitation, and geothermal use patterns during all four seasons.

c. Water quality analyses

A total of 27 chemical analyses of major and trace elements significant for interpretation of geothermal resources will be obtained. The initial analyses will be for 9 irrigation and geothermal wells. Two irrigation and three geothermal wells will be sampled and analyzed during the subsequent three climatic seasons. These data will be compared and analyzed in the context of the existing proprietary data base that contains more than 60 complete chemical analyses.

d. Temperature surveys

A precision down-hole temperature survey will be made of the 12 accessible geothermal wells on a monthly basis.

e. Hydrographic surveys

For at least two irrigation wells and two geothermal wells, obtain precision drawdown measurements on at least a monthly basis. Where accessible, measure water levels in other irrigation or geothermal wells.

4.2.2 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task.

5.0 Reports, Data, and Other Deliverables

5.1 Management records

Reports will be due as indicated on the Federal Assistance Reporting Checklist and the Report Distribution List.

5.2 Final technical reports

5.2.1a Final report, south-central New Mexico

A detailed final technical report will be prepared. The report will describe all data tables, maps, methods of research and data reduction. The report will also analyze and discuss interpretations of heat-flow, tectonic, and groundwater flow information. Various models of geothermal resources derived from site-specific studies will be analyzed within a regional framework. The report will include a complete bibliography of data sources and references.

5.2.1b Final report, Animas Valley

Prepare a final technical report on the project. This report will describe all data tables, charts, methods of research and data reduction. The report will also discuss interpretations of the hydrological information. A complete bibliography of data sources and references will be included. All proprietary data made available by Lightning Dock Geothermal to this project, including but not limited to data from well 55-7, thermal measurements, water chemical analyses, and other appropriate geologic and hydrologic data, will be made available to the public as part of the final report.

5.2.2 The final reports for each task may be produced and published in one volume, in conjunction with other appropriate documents.

6.0 Special Considerations

Successful completion of the technical tasks described above is contingent upon DOE cost-sharing these efforts with other program participants. For the study of south-central New Mexico, the New Mexico Research and Development Institute will provide additional funding. For the study of the Animas Valley, additional funding will be provided by Lightning Dock Geothermal, through an agreement with the New Mexico Research and Development Institute. Centralized management and project reporting for this program will be through the New Mexico Research and Development Institute.

PROCUREMENT REQUEST ENVIRONMENTAL PROVISIONS

Will this Procurement Request result in a significant environmental effect or will any portion of these funds be eventually used for groundbreaking, site preparation, construction, drilling, underground injection, in-situ burning, facility operation, procurement of hardware of systems for site operations, or will the expenditure of these funds result in the release of pollutants, generation of waste materials, or create a health and safety or socioeconomic impact?

Yes ____ No X

If the answer to the above is yes, what provisions (e.g., environmental impact assessment) have been made or are planned for incorporation into preprocurement documents and associated resultant contract documents which will ensure that an adequate environmental review will take place?

Environmental Provisions:

Division Director or Project Monitor
Name, Title, Date

_____
Signature

DOE F1332.1
(11-84)

U.S. DEPARTMENT OF ENERGY

REPORTING REQUIREMENTS CHECKLIST

FORM APPROVED
OMB NO. 1900-1401

1. PROGRAM/PROJECT TITLE
Small-Scale Hydropower Independent Turbine Test Laboratory

2. IDENTIFICATION NUMBER
DE-RP07-86ID12617

3. PARTICIPANT NAME AND ADDRESS
X, Y, Z Company
Moab, UT

4. PLANNING AND REPORTING REQUIREMENTS

	Frequency
A. General Management	
[X] Management Plan	O
[X] Status Report	M
[ ] Summary Report	
B. Schedule/Labor/Cost	
[ ] Milestone Schedule/Plan	
[ ] Labor Plan	
[ ] Facilities Capital Cost of Money Factors Computation	
[ ] Contract Facilities Capital and Cost of Money	
[ ] Cost Plan	
[X] Milestone Schedule/Status	A
[ ] Labor Management Report	
[X] Cost Management Report	M
C. Exception Reports	
[ ] Conference Record	
[ ] Hot Line Report	
D. Performance Measurement	
[ ] Management Control System Description	
[ ] WBS Dictionary	
[ ] Index	
[ ] Element Definition	
[ ] Cost Performance Reports	
[ ] Format 1 – WBS	
[ ] Format 2 – Function	
[ ] Format 3 – Baseline	

	Frequency
E. Financial Incentives	
[ ] Statement of Income and Expense	
[ ] Balance Sheet	
[ ] Cash Flow Statement	
[ ] Statement of Changes in Financial Position	
[ ] Loan Drawdown Report	
[ ] Operating Budget	
[ ] Supplementary Information	
F. Technical	
[X] Notice of Energy RD&D Project (Required with any of the following)	O, Y
[X] Technical Progress Report	A
[X] Draft for Review	
[X] Final for Approval	
[X] Topical Report	A
[X] Final Technical Report	F
[X] Draft for Review	
[X] Final for Approval	
[ ] Software	
[ ] Other (Specify) _____	

5. FREQUENCY CODES

A – As Required	M – Monthly	S – Semi-Annually
C – Change to Contractual Agreement	O – Once After Award	X – With Proposal/Bid/Application or with Significant Changes
F – Final (end of effort)	Q – Quarterly	Y – Yearly or Upon Renewal of Contractual Agreement

6. SPECIAL INSTRUCTIONS (ATTACHMENTS)

- [X] Report Distribution List/Addressees
- [ ] Reporting Elements
- [ ] Due Dates
- [ ] Analysis Thresholds
- [ ] Work Breakdown Structure
- [ ] Other

7. PREPARED BY (SIGNATURE AND DATE)	8. REVIEWED BY (SIGNATURE AND DATE)
P. A Brookshire 1/15/86	E M Richardson 1/24/86

ID F-129 (Rev. 08-79)
Ref. DOE 13302
(use with DOE CR 537)

U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE

REPORT DISTRIBUTION LIST

Contract No.

RFP No. DE-RP07-86ID12617

Addressees	Milestone Schedule & Status Report	Management Plan	Contract Management Summary Report	Cost Plan	Manpower Plan	Project Status Report	Cost Management Report	Manpower Management Report	Conference Record	Notice of Energy RD&D Project (SSIE)	Hot Line Report	Technical Progress Report	Final Technical Report	Topical Report	Cost Performance Report	Management Control System Description	Cost/Schedule Status Report	Summary System Description	WBS Dictionary
	Number of Report Copies																		
Peggy A.M. Brookshier U.S. Dept. Of Energy 785 DOE Place Idaho Falls, ID 83402	1	1					1	1					1	1	6*	6*			
Elaine M. Richardson (same as above)	1	1					1	1					1	1	1	1			
Earl G. Jones (same as above)								1											
John V. Flynn U.S. Dept of Energy 1000 Independence Ave., S.W. CE-34 Washington, DC 20585	1	1					1	1					1	1	1	1			
John R. Chappell EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415	1	1					1	1					1	1	2	2			
U.S. Dept. of Energy Technical Information Center P.O. Box 62 Oak Ridge, TN 37530													1						

Special Instructions

* One copy must be an unbound copy suitable for reproducing.

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA-459A (10/80)

FORM APPROVED OMB NO. 1900-0127

1. Identification Number: DE-FG07-8GID12635	2. Program/Project Title: Shredder/Compactor
3. Recipient: Impell Corporation Driggs, ID	

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
☐ Federal Assistance Milestone Plan			
☒ Federal Assistance Budget Information Form	X	1	B
☒ Federal Assistance Management Summary Report	Q	1,1,1	A, B, C, D
☒ Federal Assistance Program/Project Status Report	Q	1,1,1	A, B, D
☒ Financial Status Report, OMB Form 269	F	1, 1	B, C
TECHNICAL INFORMATION REPORTING			
☒ Notice of Energy RD&D	O (c), Y	1, 1	B, E
☐ Technical Progress Report			
☐ Topical Report			
☒ Final Technical Report	F (a)(b)	1(a)(b),1, 5	A, B, D

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final; 90 calendar days after the performance of the effort ends.
Q - Quarterly; within 30 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

(a) One "camera ready" copy of the Final Technical Report must be submitted.

(b) A draft of the Final Technical Report must be submitted for review and comment 90 days prior to final submittal of the report. A Final Technical Report as detailed in the Work Scope (Section 2) and the Technical Task (Section 4) sections will be submitted 90 calendar days after the performance of the effort ends. This report will include resolution of DOE comments on the draft Final Technical Report.

(c) Must be submitted to TIC within 30 days of award date and updated annually.

ALL REPORTS: Show complete distribution of all reports on transmittal letters to the Contracting Officer and the Project Manager.

The Final Report will be all inclusive and is all that should be entered in the TIC Data Base.

6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)
M J Barraza 3/31/86	E M Richardson 4/3/86

REPORT DISTRIBUTION LIST

U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

A. ATTN: M. J. Barainca, Program Manager
Radioactive Waste Technology Division

B. ATTN: E. M. Richardson
Contracts Management Division

C. ATTN: E. G. Jones, Director
Financial Management Division

D. J. D. Bradford
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415

E. U.S. Department of Energy
Technical Information Center
P. O. Box 62
Oak Ridge, TN 37830

MODIFICATION TO CONTRACT OR FINANCIAL ASSISTANCE

DOE F 4200.33
(Rev. 11-82)

U.S. Department of Energy
Procurement Request-Authorization

Formerly PR-799A
(Previous editions are obsolete)

To Awarding Office
Contracts Management Division

2. From Initiating Office

3. PR Number

4. Change/Correction to a PR in Process? ☐ Yes ☒ No

5. If Item 4 is yes, enter PR correction Letter N/A

6. ☐ Procurement ☐ Assistance

7. Consistent with Principal Purpose of Program? ☒ Yes ☐ No

8. Action Description/Title *(180 char. max.)*
Modification to the S.O.W.

If award is competitive, has list of sources been attached? ☐ Yes ☐ No **If Non-Competitive, Complete Items 9-11.**

9. Name

10. Division

11. Address
---

12. For Procurement Actions Only: Product or Service Code

13. For Assistance Actions Only: CFDA Number

14. Cooperative Agreement ☐

15. Grant ☐

16. Controlled Deliverable For All Actions	17. Kind of Award Action *(Recommended)*	18. Master Bin	19. Desired Award Date Mo Day Year
---			

20. Unsolicited Proposal Number

21. Project Number

22. Government Property ____ F-Furnished, P-Purchased, N-Not involved

FINANCIAL DATA

23. Government Share	24. Awardee Share	25. Total

FY FUNDS COMMITTED

26. Approp. Symbol	27. B&R Number	28. Dollar Amt.	29. Allotment	30. Object Class	31. AFP	32. CFA

33. From Continuation Sheet

34. Total Funds this PR

35. Project Period from _____ **thru** _____

36. Budget Period from _____ **thru** _____

PROJECT MANAGER/INITIATOR

37. Name	38. Signature	39 Date	40. Office Code: TD 41. FTS Telephone Number
---	---	---	---

PROGRAM REVIEWING OFFICIAL

42. Name	43. Signature	44. Date
---	---	---

PROGRAM OFFICE BUDGET OFFICIAL

45. Name	46. Signature
---	---

CERTIFYING OFFICIAL. I hereby certify that the funds cited in item 34 are available

47. Name	48. Signature	49. Date
---	---	---

CONTRACTING OFFICE

New Mexico Research and Development Institute

June 23, 1987

DIRECTOR
Larry Icerman

Ms. Peggy Brookshire
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

RE: Reprogramming of Funds under Grant No. DE-FG07-84ID12546

Dear Ms. Brookshire:

Pursuant to an informal discussion with Howard Ross, please find enclosed two (2) copies of a third addendum to the November 1985 reprogramming of some of the funds under the above grant. This third addendum has become necessary as the result of litigation prohibiting access to the lands on which the reservoir hydrology work in the Animas Valley was scheduled.

The requested reprogramming plan identifies an excellent and extraordinarily unique target of opportunity for preliminary resource assessment work. This work can be performed by the staff of one of the current subcontractors in a time frame that will not require a modification of the performance period of the above grant. This addendum includes a detailed work and a revised budget.

I hope that you will give favorable consideration to this addendum to the reprogramming plan. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:jg

cc: Howard P. Ross, URRI
File DE-FG07-84ID12546

RECEIVED
JUN 25 1987
ADVANCED TECHNOLOGY BRANCH

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

STATEWIDE GEOTHERMAL ENERGY PROGRAM FOR NEW MEXICO

Reprogramming of Funds under
Grant No. DE-FG07-84ID12546

Third Addendum to the November 1985
Request Submitted to the U.S. Department of Energy
Idaho Operations Office

by

New Mexico Research and Development Institute
1220 South St. Francis Drive
Pinon Building, Suite 358
Santa Fe, New Mexico 87501

Larry Icerman
Principal Investigator

June 1987

Background

A request for reprogramming of funds under U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12546 was submitted by the New Mexico Energy Research and Development Institute in November 1985 to make funds available to carry out three new program opportunities: (1) resource mapping; (2) reservoir hydrology; and (3) engineering assistance. Verbal approval from DOE was received for the work proposed in principle under items (1) and (2). The engineering assistance activities were judged to not be an appropriate reprogramming of funds.

In May and June 1986, respectively, detailed work plans in the areas of resource mapping and reservoir hydrology were submitted to and approved by DOE. The work under the topic of resource mapping (First Addendum) has progressed smoothly and is now in draft form as part of the full final report to be submitted under Grant No. DE-FG07-84ID12546.

The work under the topic of reservoir hydrology (Second Addendum) started in October 1986 and progressed smoothly until December 1986 when litigation concerning the rights to the lands under assessment became evident. Initially, this litigation appeared to be resolvable in a timely fashion; however, many months, if not years, are now projected to be required for a settlement to be reached. Lightning Dock Geothermal, Inc. (LDG), the subcontractor to the New Mexico Research and Development Institute (NMRDI), is not involved in the litigation directly but has, as the result of the litigation, been denied access to the lands under dispute, which constitute a significant and crucial

fraction of the hydrological assessment area. In order to ensure that DOE funds would not be used for work that could not be reported on, NMRDI suspended the subcontract to LDG on December 11, 1986. Since that time, NMRDI and LDG have pursued alternative approaches to perform the reservoir hydrology work in the Animas Valley without success.

Consequently, this third addendum is submitted as a request to reprogram the remaining balance of the funds ($41,200 of $47,500) allocated to the reservoir hydrology work to pursue a geothermal resource assessment target of opportunity that has been identified as the result of the Department of Defense selecting the U.S. Army White Sands Missile Range as the site for the construction of the Ground Based Free Electron Laser (GBFEL) Facility. This facility will be located near Orogrande in Otero County, New Mexico.

This addendum contains a detailed work plan associated with this target of opportunity resource assessment work and a proposed revised budget. The reprogramming plan proposes to utilize the same LDG staff assigned to the reservoir hydrology work to carry out the reprogrammed work on day-to-day basis. Because of the uniqueness and time frame of the target of opportunity that has been identified, the performance period for Grant No. DE-FG07-84ID12546 should not require modification.

Target of Opportunity Resource Assessment

Introduction

Orogrande, New Mexico, is located at the southern extent of the Tularosa Basin, which is part of the Basin and Range Province

and is on the eastern boundary of the southern Rio Grande rift (see Figure 1). Because this area has been under continuous control of the U.S. Army for more than forty years, very limited data are available from which the geothermal energy potential may be assessed. This target of opportunity to conduct preliminary resource assessment work represents an unusual chance to collect data because once the GBFEL construction has been completed access to this site will once again be restricted.

McLean (1970) has summarized the geology and hydrology of the Tularosa Basin. Seager (1980, 1982) has developed a comprehensive analysis and model of the western, basin-bounding mountains and fault structure. The Jarilla Fault Zone is postulated (King and Harder, 1982) to be one of the major structural controls for potential geothermal resources in the eastern Tularosa Basin. Although the Jarilla Fault Zone has not been mapped in detail, the southern extent of the fault is inferred (see Figure 2) to be nearby the location selected for the GBFEL site.

Research Design

During the summer of 1987, considerable geotechnical work will be conducted by the U.S. Army Corps of Engineers in support of the construction of the GBFEL. Approximately 40 soil test borings to depths ranging from 40 to 200 feet will be made. In addition, Fluor Constructors, the principal construction contractor for GBFEL, will drill a water test well to a planned depth of 1,200 feet. Only limited geophysical logs and test pumping are planned. The proposed research methodology is to capitalize on this once-in-a-lifetime target of opportunity presented by the

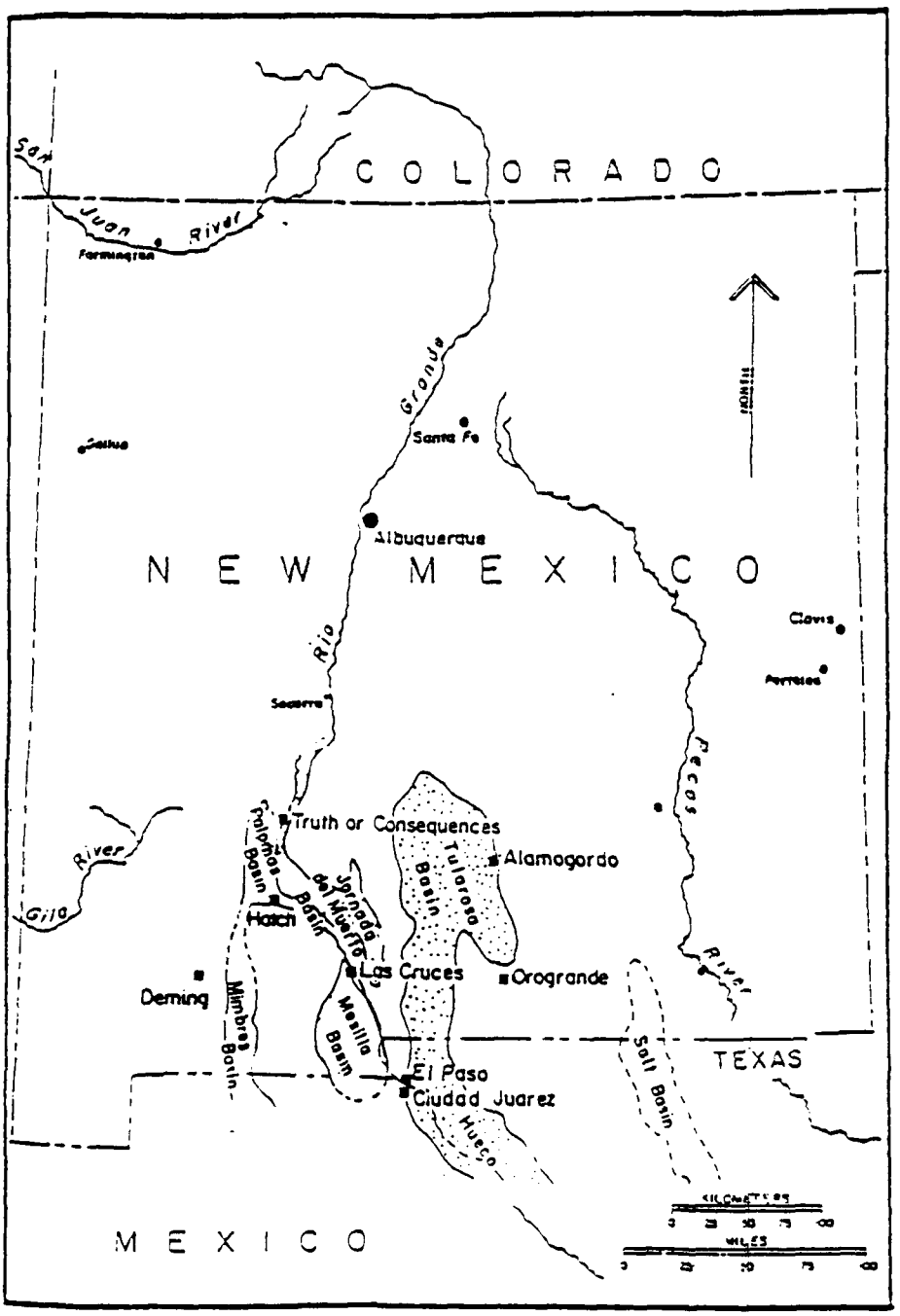

Figure 1. Location Map for the Tularosa Basin.

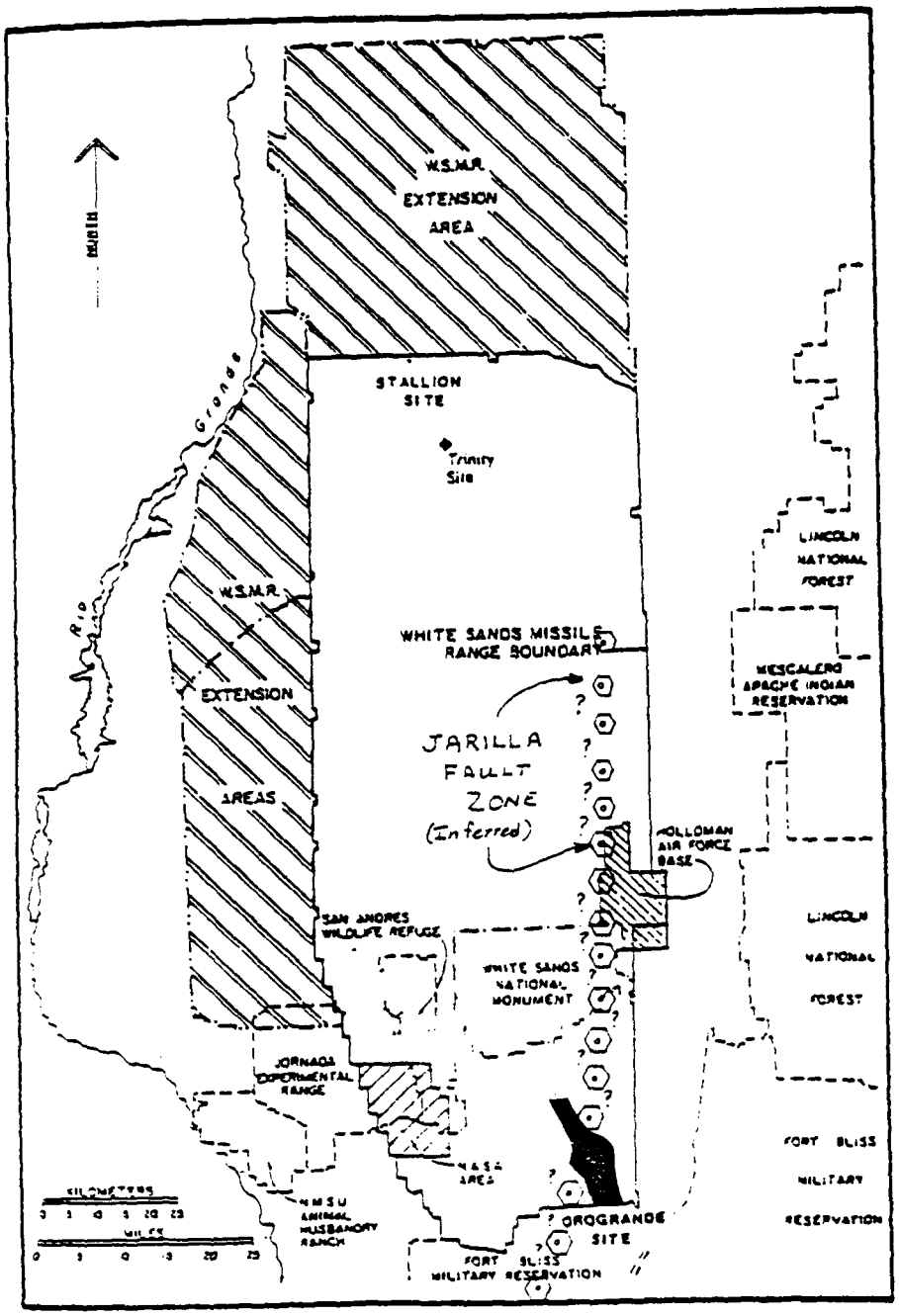

Figure 2. Inferred Location of the Jarilla Fault Zone Intersecting the Site of the Ground Based Free Electron Laser Facility.

geotechnical work to performed by the Corps by conducting detailed geophysical and hydrological resource assessment work in conjunction with the test borings and the test water well. Informal coordination has already been made with the Corps, both the Huntsville and the Ft. Worth Districts, the Chief Scientist and Technical Director at White Sands Missile Range, the U.S. Geological Survey (USGS), and the Fluor Constructors Project Manager. The concept of performing additional geophysical and hydrological studies during the summer of 1987 has been received well by these organizations and individuals who are in charge of the planned geotechnical work.

Work Plan

The proposed work will be conducted as two major field tasks. The results of each of these two tasks will be synthesized in a third task to provide a preliminary geothermal resource assessment of the Orogrande area.

Task 1: Test Borings/Temperature-Gradient Holes

In cooperation with the Corps, the planned locations for the soil test borings will be reviewed to select 11 test holes for completion as temperature-gradient holes. The holes will be selected to provide the maximum practical coverage of a zone extending up to six miles in a southeast-northwest alignment to maximize the probability of intersecting the Jarilla Fault Zone. Because the target depths of the test borings range from 40 to 200 feet, a request will be made to the Corps to deepen at least three of the 40-foot holes to a depth of 100 feet so that all of the holes to be completed as temperature-gradient holes will be a

minimum of 100 feet in depth. The 11 temperature-gradient holes will be completed using standard field techniques as part of this reprogrammed work plan. Following the completion of the holes, temperature data will be collected and the holes will be abandoned in accordance with federal and state regulations.

The temperature data will be acquired, using equipment provided by LDG, in three separate time intervals. Analyses of the temperature data will be performed, and temperature-gradient contour maps will be prepared.

Task 2: Water Test Well/Reservoir Assessment

In collaboration with the Corps, USGS, and Fluor Constructors, input will be provided to the planning and drilling of a 1,200-foot test well to maximize the opportunity to collect geophysical and hydrological data for the purpose of making a preliminary geothermal reservoir assessment. This well will be drilled by Fluor Constructors. The work will involve: (1) determination of the geophysical logs and temperature surveys to be acquired; (2) review and approval of the plans for obtaining and analyzing drill cuttings and water samples; and (3) development of a plan to conduct a hydrological assessment of the reservoir based on the scheduled pump tests.

Analyses will be performed on the geophysical logs, temperature data, water quality data, and drill cuttings. Pump test data will be utilized to estimate the hydrological parameters of the potential geothermal reservoir.

Task 3: Data Evaluation and Interpretation

All of the data collected and analyzed in Tasks 1 and 2 will be evaluated and interpreted in order to develop a preliminary assessment of the geothermal energy potential of the Orogrande, New Mexico, area adjacent to the GBFEL facility. A detailed final technical report will be prepared. The report will include all of the data collected, the data analyses, and qualitative and quantitative assessments of the geothermal energy potential of the study area.

Research Staff

Roger Bowers, Vice President of LDG, will supervise and conduct the work related to the geothermal evaluations and analyses. Mr. Bowers is a widely recognized geologist in the geothermal energy community. He served as the Geothermal Program Manager for Hunt Energy Corporation for 12 years. Mr. Bowers directed the extensive geothermal exploration effort by Hunt Energy Corporation in Dona Ana County, New Mexico, in 1982-83.

Mr. Roy Cunniff, President of LDG, will supervise and conduct the engineering aspects of the evaluations and analyses. Mr. Cunniff was the Project Engineer for the highly successful New Mexico State University Campus Geothermal Project. That project included drilling a new production well, an observation well, and a new disposal well. As Project Engineer for the San Bernardino geothermal system, Mr. Cunniff was responsible for the drilling program, in which two deep gradient wells of 1,380 and 1,985 feet were drilled and one new production well was completed in early September 1984. Mr. Cunniff also was the head of the

engineering team that conducted a reservoir assessment of the Radium Springs, New Mexico, geothermal field in May 1983 for Hunt Energy Corporation.

Company Profile

The proposed field studies will be subcontracted to LDG, which was first organized as a partnership in February 1986. Later in 1986, the partners organized and incorporated the company under the laws of the State of New Mexico. The firm originally was incorporated to own and develop the Lightning Dock KGRA in the Animas Valley of New Mexico. The federal geothermal lease, which controls the geothermal direct-heat usage by three different greenhouse firms, and the Test for Discovery Well 55-7, drilled by Steam Reserve Corporation in 1985, are partnership assets in process of being transferred to the Corporation. The company has also purchased lease rights from the State of New Mexico for an additional 1,500 acres adjoining the federal lease. Under its charter, the corporation can engage in geothermal resource assessment, resource development, and associated endeavors.

Program Organization

Larry Icerman, NMRDI Director, will continue to serve as the Principal Investigator of the reprogrammed research. Dr. Icerman has been actively involved in geothermal energy development in New Mexico since 1980 and has been Principal Investigator for more than 20 geothermal research, development, and commercialization projects valued at over $1.5 million. He has extensive management and field experience in geothermal drilling programs

in New Mexico and is the editor, co-editor, author, or co-author of more than 30 papers and reports on geothermal energy exploration and development.

Program Duration

A five-month period is proposed to conduct the reprogrammed work. This schedule will allow adequate time to coordinate the work plan with all involved organizations, to complete the proposed field activities and analyses, while still leaving sufficient time to interpret and report on the results.

Deliverables

The results of all of the work, including the preliminary reservoir hydrology work in the Animas Valley, conducted under Grant No. DE-FG07-84ID12546 will be reported on in the form of a comprehensive final technical report. This report will be edited by Larry Icerman. Public dissemination of the information will be provided through the established NMRDI information dissemination program. This effort distributes approximately 5,000 copies of research and development reports annually.

Budget

The revised budget summary (see Table 1) outlines the commitment and expenditure of funds under this addendum. Substantial administrative costs will be borne by NMRDI. The State of New Mexico considers administrative costs to be a contribution not a match. A budget detail for the reprogrammed work to be performed by LDG as a subcontractor is given in Table 2.

References

King, W.E., and Harder, V.M., 1982, Oil and gas potential of the Tularosa Basin -- Otero platform area, Otero County, New

Mexico: New Mexico Energy Research and Development Institute, EMD 2-68-3205, 69 p.

McLean, J.S., 1970, Saline ground-water resources of the Tularosa Basin, New Mexico: Office of Saline Water, Research and Development Progress Report 561, 128 p.

Seager, W.R., 1980, Quaternary fault system in the Tularosa and Hueco basins, southern New Mexico and West Texas, in Trans-Pecos Region, in 31st Field Conference Guidebook: New Mexico Geological Society, p. 131-136.

Seager, W.R., 1981, Geology of Organ Mountains and southern San Andres Mountains, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Memoir 36, 97 p.

Table 1. Budget Summary

Revised Work Plan

(Third Addendum)

	DOE	NMRDI	EMD	NMSU	LDG
Administration	$ 10,500	$ 6,500	$1,000	-0-	-0-
Personnel Services, Benefits, Travel, Supplies, Telephone, Copying, Mailing					
Report Preparation and Publication	2,000	500	-0-	-0-	-0-
Contractual Programs					
NMSU geothermal well	19,970	-0-	-0-	$50,000	-0-
Resource mapping	30,000	25,000	-0-	-0-	-0-
Reservoir hydrology	6,300	-0-	-0-	-0-	$45,000
Moderate-to-intermediate temperature reservoir characterization (NMSU) well contingency funds)	-0-	-0-	-0-	-0-	-0-
Target of opportunity (Orogrande)	41,200	-0-	-0-	-0-	-0-
Subtotals	$109,970	$32,000	$1,000	$50,000	$45,000
Total Program Costs		$237,970			
DOE Funds		$109,970			
State Contribution					
Administration and Report Preparation Cost Waiver		$ 8,000			
Contractual Programs		$ 75,000			
Lightning Dock Geothermal Contribution		$ 45,000			
Total Contributions		$128,000			

TABLE 2. Subcontractor Budget Detail

	DESCRIPTION	$ COST
TASK 1	TEMPERATURE GRADIENT DATA	
PURCHASED SERVICES		
	AREA 1: COMPLETE 3 HOLES	$600
	AREA 2: COMPLETE 4 HOLES	$2,500
	AREA 3: COMPLETE 4 HOLES	$2,000
	SUBTOTAL	$5,100
FIELD WORK		
	COORDINATE DRILLING AND COMPLETION (10 HOURS PR HOLE; 11 HOLES; 110 HOURS @ $30)	$3,300
	TEMPERATURE GRADIENT LOGGING (3 HOLES PER DAY; 4 DAYS FOR ONE SURVEY; 3 SURVEYS = 12 DAYS; 12 DAYS @ 10 HOURS @ $30)	$3,600
	SUBTOTAL	$6,900
TRAVEL COSTS		
	AIRFARE: 3 R/T TRIPS DALLAS @ $300	$900
	PER DIEM: 15 DAYS @ $75	$1,125
	MILEAGE: 15 DAYS @ 250 MILES @ $0.20	$750
	SUBTOTAL	$2,775
TASK TOTAL COST		$14,775
TASK 2	GEOTHERMAL ASSESSMENT OF TEST WELL	
PURCHASED SERVICES		
	COST-SHARED GEOPHYSICAL LOGS	$2,000
	COST-SHARED PRESSURE RECOVERY TEST	$2,500
	SUBTOTAL	$4,500
FIELD WORK		
	COORDINATE DRILLING AND TESTING (40 HOURS @ $30)	$1,200
	SUPERVISE DATA COLLECTION (40 HOURS @ $30)	$1,200
	CONDUCT HYDROLOGY TEST (50 HOURS @ $30)	$1,500
	SUBTOTAL	$3,900
TRAVEL COST		
	AIRFARE: 1 R/T DALLAS; COORD W/ C.E.	$300
	PERDIEM: 2 DAYS @ $75	$150
	15 DAYS @ $25	$375
	MILEAGE: 15 DAYS @ 250 MILES @ $0.20	$750
	SUBTOTAL	$1,575
TASK TOTAL COST		$9,975
TASK 3	FINAL REPORT	
DATA EVALUATION	EVALUATE DRILL CUTTINGS, GEOPHYSICAL LOGS, WATER QUALITY ANALYSES, TEMP. DATA, AND HYDROLOGY DATA.	
FINAL REPORT	PREPARE FINAL REPORT	
	PROFESSIONAL LABOR: 220 HOURS @ $30	$6,600
	SUPPORT LABOR: 100 HOURS @ $10	$1,000
	CONSULTANT:	
	(DR. BILL SEAGER, 40 HOURS @ $30)	$1,200
	TELEPHONE	$550
	COPYING	$100
	MAINTENANCE & REPAIRS	$100
	SUPPLIES	$100
	POSTAGE	$99
	COMPUTER	$350
	TRAVEL	
	ONE R/T DALLAS; COORD W/CORPS OF ENG	$300
	ONE TRIP SANTA FE; FINAL REPORT	$300
TASK TOTAL COST		$10,699
COST SUMMARY	TASK 1 TOTAL COST	$14,775
	TASK 2 TOTAL COST	$9,975
	TASK 3 TOTAL COST	$10,699
	SUBTOTAL	$35,449
	OVERHEAD @ 10 %	$3,545
	SUBTOTAL	$38,994
	GROSS RECEIPTS TAX @ 5.625 %	$2,193
	TOTAL ESTIMATED COST	$41,187

U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

June 30, 1987

Dr. Larry Icerman, Director
New Mexico Research and Development Institute
Pinon Building, Suite 358
1220 South St., Francis Dr.
Santa Fe, NM 87501

SUBJECT: Reprogramming of Funds - Grant DE-FG07-84ID12546

Dear Dr. Icerman:

We have received your request for reprogramming the funds for the above grant. Since your request is similar to the proposal you submitted under the State Research and Development PRDA, we will not make a determination until the PRDA selecton process is completed.

If you have any questions, please call me.

Very truly yours,

Peggy A.M. Brookshier

Peggy A.M. Brookshier
Project Manager
Advanced Technology Division

cc: Jeff Hoyles, DOE-ID
Marshall Reed, DOE-HQ
Howard Ross, UURI

U.S. DEPARTMENT OF ENERGY

DOE F 4220.2 (6-80) (Formerly PR-415)

SMALL BUSINESS/LABOR SURPLUS SET-ASIDE REVIEW

I.D. NO. PR Number

ITEM TITLE/DESCRIPTION

SMALL BUSINESS SIZE STANDARD RECOMMENDED BY S.B. SPECIALIST
EMPLOYEES NUMBER _____
DOLLAR $ _____
SIC CODE: _____

PROGRAM OFFICE: Conservation Tech. Div.

PROCURING ACTIVITY:

* SB/LS PARTICIPATION WAS CONSIDERED IN THE PREPARATION OF THIS PROCUREMENT ITEM AND FOLLOWING IS RECOMMENDED:

- ☐ Small Business Set-Aside _____ % $ _____
- ☐ Labor Surplus Set-Aside _____ % $ _____
- ☐ SBA Section 8(a) Procurement
- ☐ Set-Aside Action Not Recommended

NAME AND LOCATION OF PROPOSED SOURCE: (If Sole Source)

- ☐ Small Business ☐ Minority
- ☐ Labor Surplus Firm ☐ Other

* SET-ASIDE NOT FEASIBLE BECAUSE:

- ☐ No Reasonable Expectation of Receiving Sufficient Offers from SB/LS Firms to Assure Award*
- ☐ Program Objectives Dictate Broadest Possible Solicitation to Obtain "Best Available" Expertise*
- ☐ Solicitation if for "Best Idea/Approach" R&D Effort
- ☐ Continuing and Directly Related R&D Effort. Competitive Procurement Not Feasible for Economic and/or Technical Reasons
- ☐ Procurement is for Completion or Within-Scope Expansion of Current Contract
- ☐ This is for Extension of Current Services to Allow Preparation/ Award of Competitive Follow on Procurement
- ☐ Sole Source as Determined Under Current DOE Policy Directives Funding of Unsolicited Proposal Under Current DOE Policy Directives
- ☐ Other*

*Explanation Required

EXPLANATION/ADDITIONAL COMMENT:

SMALL BUSINESS SPECIALIST CONSULTED *(Check One)* ☐ Yes ☐ No

TELEPHONE

P.R. REQUESTOR DATE

SMALL BUSINESS SPECIALIST'S ENDORSEMENT

- ☐ Accepts ☐ Requests Reevaluation
- ☐ Request Solicitation of SB/LS Sources Attached
- ☐ Request Special SB/LS/MB Incentive Provisions (Attached)
- ☐ Other Comments/Attached

SMALL BUSINESS SPECIALIST DATE

REEVALUATION OF RECOMMENDATIONS/FINDINGS

- ☐ Reaffirmed
- ☐ Set-Aside Feasible

AUTHORIZING PROGRAM OFFICIAL DATE

REVIEWED BY SBA

- ☐ Request Solicitation of SB Sources Attached
  SBA Form 70 Attached ☐ Yes ☐ No

SBA REPRESENTATIVE DATE

PROCUREMENT OFFICER'S ACTION

- ☐ SB/LB Set-Aside ☐ Set-Aside Not Initiated
- ☐ Other Recommendations/Request Noted and Appropriate Action Taken

PROCUREMENT OFFICER DATE

CONTRACT NO.(S) SB/MB/OTHER

ORIGINAL-CONTRACT FILE (FULLY EXECUTED)

August 13, 1986

MEMORANDUM

TO: Peggy Brookshier

FROM: Duncan Foley

RE: State Program RFP; New Mexico Statement of Work

I have enclosed a draft text for portions of the upcoming RFP under the State Cooperative Resource Analysis Program. I hope that this provides you with the beginning of what you need.

I have also enclosed the revised New Mexico Statement of Work that we discussed today. I have extended it to two years, and made the other adjustments that Larry Icerman requested.

A few questions need to be resolved on the RFP. Among these are:

1. Weighting factors for evaluation criteria need to be developed.

2. A method needs to be established to handle pre-proposal questions.

3. The text needs the "Other Pertinent Information" section (see pages 17 - 23 of this years Cascades SCAP).

4. The makeup of the proposal review panel needs to be considered, so it can be described adequately in the RFP.

I have not yet developed a mailing list of program participants. Do you want this to go to state agencies that were active in the past, but which have not been funded for several years (e.g. Texas, Colorado, etc.)? I have also not yet added the program descriptions for ongoing efforts in Nevada and Hawaii. These will be forthcoming soon.

As presently written, the text calls for an appendix listing all DOE/GTD programs. Do you have such a list that we can just put into the RFP? Or shall we change the text?

I will contact you to get your feedback.

Duncan Foley

New Mexico Research and Development Institute
(formerly New Mexico Energy Research and Development Institute)
Suggested Scope of Work and Statement of Work
August 7, 1986
13

STATEMENT OF WORK

1.0 Introduction

The goal of this grant modification is to support cost-shared research on geothermal resources in New Mexico. This will be accomplished through reprogramming previously allocated funds. The unspent monies were previously allocated through the State Cooperative Program for geothermal research in New Mexico. The State of New Mexico attempted to obtain an industry cost share for the funds through an RFP procedure. Although several firms responded to the RFP, none of the selected respondents were able to produce their cost share in a timely manner. Thus, the funds are available for reprogramming.

Two major research programs will be accomplished through this modification. The first is to compile and interpret all available geothermal-related data for south-central New Mexico. This will be a detailed study of the relationships between groundwater flow, heat flow, subsurface structure, and geothermal resources. The product will be a series of maps and a technical report. This effort will also be supported by the State of New Mexico. The second research program will be to perform a comprehensive hydrological survey of geothermal anomalies in the Animas Valley. This is a complex geothermal area, with shallow production separated from a possible deeper, hotter system. Cooperation with industry in this program will result in much previously proprietary data becoming public. A letter of agreement with the private sector participant is included in the proposal.

2.0 Scope

The technical objectives of this grant modification are to develop map-based syntheses of existing geoscientific data related to geothermal resources in south-central New Mexico, and to develop a detailed understanding of the inter-relationships of geothermal and irrigation groundwater systems in the Animas Valley area. The technical efforts are described in 4.0 below. Each of these tasks will be cost-shared by DOE and another other program participant. The duration of research will be two years. Final technical reports for each task will be prepared.

3.0 Applicable Documents

The effort described herein is a modification of DOE grant DE-FG07-84ID12546, as requested through letters and proposals from the New Mexico Research and Development Institute, dated May 8 and June 18, 1986. These letters and proposals commit the Research and Development Institute and Lightning Dock Geothermal to cost share in the proposed efforts.

4.0 Technical Tasks

The following tasks will be accomplished through this grant modification.

4.1 Compilation of geothermal data for south-central New Mexico

4.1.1 Compile data to prepare maps of seven different parameters. This compilation will be cost shared with the New Mexico Research and Development Institute. The tasks are:

a. Compile a location map and list of data sources

b. Compile all existing heat flow data

c. Compile temperature gradient data from all available holes

d. Compile tectonic and geologic data, to develop a geologic map including Teriary subcrops, pre-Tertiary lithology distribution and geologic structures. Where appropriate, other Tertiary and younger geologic features relevant to geothermal resources, such as volcanic vents, should also be indicated.

e. Compile water table elevations, to indicate groundwater flow regimes, such as zones of recharge, discharge, and flow constriction

f. Compile depths to water table

g. Compile locations of site-specific studies

No original data will be collected; only data available from previous studies will be used. The maps will be compiled at a scale of at least 1:500,000; these will be reduced to 8 1/2 by 11 inch page size for the final report. The larger maps will be made available to interested researchers through open-file or other appropriate procedures.

4.1.2 Final Report

A final report, described under 5.2.1, will be prepared as part of this task.

4.2 Geothermal Reservoir hydrology of the Animas Valley

4.2.1 The following five tasks will be accomplished in the area of geothermal anomalies in the Animas Valley. These efforts will be cost shared with Lightning Dock Geothermal.

a. Review and evaluate existing hydrologic data.

Include all data and reports available in the public domain, and previously proprietary data being made available through this study. These data include detailed water chemistry, temperature surveys, or hydrographic data from about 60 irrigation wells, and

previously proprietary water chemistry and temperature surveys from 12 shallow geothermal wells. Reinterpret all data, including data from well 55-7. Evaluate these data to determine, to the extent possible, drawdown due to geothermal fluid extraction and the potential for communication between geothermal and irrigation wells. Systematically evaluate the temperature, mineral content, and water level for the 72 wells.

b. Field work.

Select nine irrigation and three geothermal wells from those identified above for detailed study. The basis of selection will be a distribution to assure areal coverage and currently existing data. Measure temperatures and water chemistry for the wells at least monthly. Interpret the results of these measurements in terms of irrigation, precipitation, and geothermal use patterns during all four seasons.

c. Water quality analyses

A total of 27 chemical analyses of major and trace elements significant for interpretation of geothermal resources will be obtained. The initial analyses will be for 9 irrigation and geothermal wells. Two irrigation and three geothermal wells will be sampled and analyzed during the subsequent three climatic seasons. These data will be compared and analyzed in the context of the existing proprietary data base that contains more than 60 complete chemical analyses.

d. Temperature surveys

A precision down-hole temperature survey will be made of the 12 accessible geothermal wells on a monthly basis.

e. Hydrographic surveys

For at least two irrigation wells and two geothermal wells, obtain precision drawdown measurements on at least a monthly basis. Where accessible, measure water levels in other irrigation or geothermal wells.

4.2.2 Final Report

A final report, described under 5.2.1 below, will be prepared as part of this task.

5.0 Reports, Data, and Other Deliverables

5.1 Management records

Reports will be due as indicated on the Federal Assistance Reporting Checklist and the Report Distribution List.

5.2 Final technical reports

5.2.1a Final report, south-central New Mexico

A detailed final technical report will be prepared. The report will describe all data tables, maps, methods of research and data reduction. The report will also analyze and discuss interpretations of heat-flow, tectonic, and groundwater flow information. Various models of geothermal resources derived from site-specific studies will be analyzed within a regional framework. The report will include a complete bibliography of data sources and references.

5.2.1b Final report, Animas Valley

Prepare a final technical report on the project. This report will describe all data tables, charts, methods of research and data reduction. The report will also discuss interpretations of the hydrological information. A complete bibliography of data sources and references will be included. All proprietary data made available by Lightning Dock Geothermal to this project, including but not limited to data from well 55-7, thermal measurements, water chemical analyses, and other appropriate geologic and hydrologic data, will be made available to the public as part of the final report.

5.2.2 The final reports for each task may be produced and published in one volume, in conjunction with other appropriate documents.

6.0 Special Considerations

Successful completion of the technical tasks described above is contingent upon DOE cost-sharing these efforts with other program participants. For the study of south-central New Mexico, the New Mexico Research and Development Institute will provide additional funding. For the study of the Animas Valley, additional funding will be provided by Lightning Dock Geothermal, through an agreement with the New Mexico Research and Development Institute. Centralized management and project reporting for this program will be through the New Mexico Research and Development Institute.

New Mexico Research and Development Institute

Acting
DIRECTOR
Larry Icerman

July 7 86

June 18, 1986

Ms. Peggy Brookshier
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Re: Reprogramming of Funds Under Grant No. DE-FG07-84ID12546

Dear Ms. Brookshier:

Pursuant to several informal discussions with Duncan Foley, please find enclosed two (2) copies of a second addendum to the November 1985 proposed plan for reprogramming some of the funds under the above grant. This addendum contains a more detailed work plan associated with the reservoir hydrology activities suggested and approved in principle earlier. Also included is a proposed revised budget and resumes of the individuals who will carry out the work on a day-to-day basis. A 12-month no-cost extension of the performance period from September 30, 1986, to September 30, 1987, for Grant No. DE-FG07-84ID12546 is requested to cover fully the proposed work period for the reprogrammed activities.

As in the past, the New Mexico Research and Development Institute has negotiated an additional pledge of $48,750 from Lightning Dock Geothermal, Inc. as a contribution to further the work contained in this addendum. This amount exceeds the budget of $47,500 requested for reprogrammed activities on reservoir hydrology. The pledged contributions to the Grant now total $131,750.

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

I hope that you will give favorable consideration to both of the addenda to the reprogramming plan. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Acting Director

LI:al

Enclosures

cc: Duncan Foley, URRI
File DE-FG07-84ID12546

New Mexico Research and Development Institute

May 8, 1986

Acting
DIRECTOR
Larry Icerman

Ms. Peggy Brookshier
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Re: Reprogramming of Funds Under Grant No. DE-FG07-84ID12546

Dear Ms. Brookshier:

Pursuant to several informal discussions with Duncan Foley, please find enclosed two (2) copies of an addendum to the November 1985 proposed plan for reprogramming some of the funds under the above grant. This addendum contains a more detailed work plan associated with the reservoir mapping activities suggested and approved in principle earlier. Also included is a proposed revised budget and resumes of the individuals who will carry out the work on a day-to-day basis. A nine-month no-cost extension of the performance period from September 30, 1986, to June 30, 1987, for Grant No. DE-FG07-84ID12546 is requested to cover fully the proposed work period for the reprogrammed activities. A second addendum containing a detailed work plan for the reservoir hydrology studies is in preparation and will be forwarded shortly under separate cover.

I hope that you will give favorable consideration to this addendum to the reprogramming plan. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Acting Director

LI:cc

Enclosures

cc: Duncan Foley, URRI
File DE-FG07-84ID12546

Piñon Building, Suite 358, 1220 South St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

ESL ——
May 19, 1986

nb-Jan. 23, 1986

STATEWIDE GEOTHERMAL ENERGY PROGRAM FOR NEW MEXICO

Reprogramming of Funds under
Grant No. DE-FG07-84ID12546

Addendum to the November 1985
Request Submitted to the U.S. Department of Energy
Idaho Operations Office

by

New Mexico Research and Development Institute
1220 South St. Francis Drive
Pinon Building, Suite 358
Santa Fe, New Mexico 87501

Larry Icerman
Principal Investigator

May 1986

Background

A request for reprogramming of funds under U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12546 was submitted by the New Mexico Energy Research and Development Institute in November 1985 to make funds available to carry out three new program opportunities: (1) resource mapping; (2) reservoir hydrology; and (3) engineering assistance. Verbal approval from DOE was received for the work proposed in principle under items (1) and (2). The engineering assistance activities were judged to not be an appropriate reprogramming of funds.

In response to the request made by DOE, this addendum, submitted by the New Mexico Research and Development Ir (NMRDI), contains a more detailed work plan associated v resource mapping activities suggested and approved in p earlier. Also included is a proposed revised budget and of the individuals who will carry out the work on a da basis. A nine-month no-cost extension of the performanc for Grant No. DE-FG07-84ID12546 is requested to cover f proposed work period for the reprogrammed activities. addendum containing a detailed work plan for the hydrology studies is in preparation and will be submitte near future.

Resource Mapping

Introduction

Considerable site-specific geological, geophysical, and geochemical information exists for geothermal resources in south-

central New Mexico. Compilation of these data for an integrated and comprehensive regional overview is needed for future development, planning, exploration, and research. The New Mexico Scientific Series geothermal maps provide a basis for a regional overview (Swanberg et al., 1983). However, this map series contains only a small fraction of the temperature-gradient and heat-flow information that is currently available (Icerman and Lohse, 1983; Lohse et al., 1985).

Since the publication of the Scientific Series maps, several new geothermal studies have been conducted and a large amount of private data has been released by firms that have performed geothermal exploration activities in New Mexico (Icerman and Lohse, 1983; Lohse et al., 1985). Detailed groundwater data for New Mexico that are useful for geothermal studies have also been published recently (USGS, 1985). Furthermore, structural information relative to geothermal resources has not been compiled and presented systematically on a regional basis.

Detailed study of the relationships between groundwater flow, heat flow, subsurface structure, and geothermal resources has not been performed on a regional scale in south-central New Mexico. Preliminary studies by Morgan et al. (1981) suggest that regional and subregional groundwater flow systems, controlled in part by large-scale geological structures, have an important influence on the occurrence and localization of south-central New Mexico geothermal resources. An updated compilation of available data will contribute to a better understanding of the nature of south-central New Mexico geothermal resources.

Research Design

The overall objective of the proposed work is to compile and interpret all available geothermal-related data for south-central New Mexico. The study area (see Figure 1) is selected because of the wealth of information available from prior site-specific studies and because of the co-location of the geothermal resources with population centers in the southern Rio Grande Valley.

Important geothermal information not shown on the Scientific Series maps will be detailed. Various models of geothermal occurrence derived from site-specific studies will be analyzed within a regional framework. Most important, detailed analyses of the relationships between heat flow, groundwater flow, and regional structure will be performed. Data and information compiled by this study will be presented in a serie
and maps.

All available heat-flow, temperature-gradient,
hole temperature data will be compiled for the s
Grande Rift. Because many different data sources exis
is significant variation in data quality, a simple
evaluation method is required. The classification scheme of Reiter et.al. (1975) is a suitable method of approach. Contour maps of heat-flow and temperature-gradient data will be produced for comparison and analysis with other geological maps and information.

Compilation of tectonic and structural information will provide the basis for preparation of a Tertiary subcrop map.

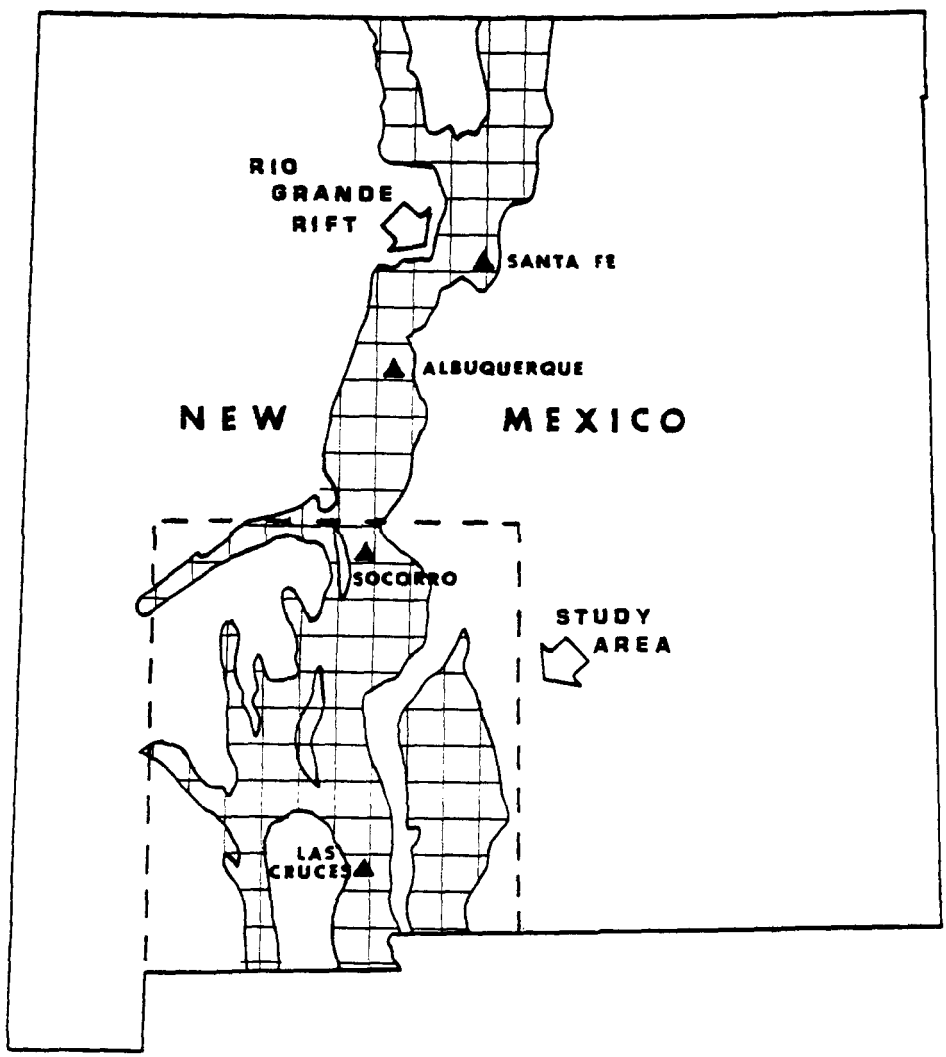

Figure 1. Proposed Study Area Location Map. The boundaries of the study area are: north, 34°12'; south, New Mexico-Texas-Mexico border; east, 105°48'; west, 108°12'. The area covers about 25,000 square miles and includes all of Dona Ana, Luna, and Sierra counties and parts of Catron, Grant, Lincoln, Otero, and Socorro counties.

Pre-Tertiary lithology distribution is believed to have important control on the location of many geothermal resources because these rocks provide a host for reservoirs and control subsurface fluid flow in many areas.

Water-table elevation maps and water-table depth maps will also be compiled for the region. These maps will be valuable in interpreting heat-flow data. Regional water-table elevation maps will indicate groundwater flow regimes such as zones of discharge, recharge, and flow constriction. Zones of discharge and constriction apparently coincide with many geothermal areas (Morgan et.al., 1981). In other areas where strong lateral water flow creates a uniform temperature at the top of an aquifer, the water table can act as a shallow heat source. In such instances, areas with shallow depth-to-water values will often exhibit high apparent temperature-gradient values, while nearby areas over the same aquifer with greater depth-to-water values will show a normal temperature gradient. Thus, comparison of depth-to-water data with temperature-gradient information will assist in evaluating heat-flow data as an indicator of geothermal potential.

Work Plan

Data files for mapping seven different parameters will be compiled including:

(1) location and data sources;

(2) heat flow;

(3) temperature gradients;

(4) tectonic (Tertiary subcrop);

(5) water table elevation;

(6) depth to water table; and

(7) location of site-specific studies.

Maps will be produced in an 8 1/2" by 11" format -- data files for inclusion in the final report. A l d data sources map will be produced first. l geotechnical data will be collected; only data n prior studies will be used. The heat-flow a gradient data will be incorporated onto separate lines will be hand drawn at appropriate interval subcrop map will be produced with supporting tectonic data. Two water-table maps will provide both the absolute ele water table and the depth to the water table. Fina site-specific studies within the southern Rio Grand produced.

Deliverables

A detailed final technical report will be submission to DOE. The report will describe all data tables, maps, methods of research, and data reduction. The report will also discuss interpretations of heat-flow, tectonic, and groundwater-flow information. A complete bibliography of data sources and references will be included in the report.

Research Staff

Dr. Rudi Schoenmackers, Director of the New Mexico State University Energy Institute, will direct the work on a day-to-day basis. Dr. Schoenmackers has worked closely with various state and federal agencies involved with geothermal projects and is

familiar with a broad range of New Mexico geothermal studies. Mr. Jim Witcher will be responsible for the majority of the research involving data collection, map preparation, and analysis. Mr. Witcher has recently completed graduate coursework in geology and geophysics at New Mexico State University, emphasizing southern New Mexico geothermal resources, and is thus very knowledgeable about both data sources and current theories concerning the nature and distribution of geothermal resources in southern New Mexico. Previously, Mr. Witcher worked for several years in Arizona on geothermal resource characterization projects and coauthored the Geothermal Resources of Arizona public map series supported by DOE. Mr. Jack Whittier has been involved in New Mexico geothermal resource exploration for over three years and has experience in regional mapping studies in southern New Mexico (see attached resumes).

Program Organization

Larry Icerman, NMRDI Acting Director, will continue to serve as the Principal Investigator of the revised research program. Dr. Icerman has been actively involved in geothermal energy development in New Mexico since 1980 and has been Principal Investigator for more than 20 geothermal research, development, and commercialization projects valued at over $1.5 million. He has extensive management and field experience in geothermal drilling programs in New Mexico and is the editor, co-editor, author, or co-author of more than 30 papers and reports on geothermal energy exploration and development.

Program Duration

A 12-month period is proposed to conduct the reprogrammed work plan. This schedule will allow adequate time to prepare contracts for the resource mapping and reservoir hydrology work, to complete the proposed analysis and field activities, while still leaving sufficient time to interpret and report on the results. A nine-month no-cost time extension for the performance period of Grant No. DE-FG07-84ID12546 is requested from September 30, 1986, to June 30, 1987, in order to complete the reprogrammed research plan.

Deliverables

The results of all of the work conducted under Grant No. DE-FG07-84ID12546 will be reported on in the form of a comprehensive final technical report. This report will be edited by Larry Icerman. Public dissemination of the information will be provided through the established NMRDI information dissemination program. This effort distributes approximately 5,000 copies of research and development reports annually.

Budget

The revised budget detail outlines the commitment and expenditure of funds under this addendum. Substantial administrative costs will be borne by the NMRDI. The State of New Mexico considers administrative costs to be a contribution not a match.

References

Icerman, L., and Lohse, R. L., 1983, Geothermal low-temperature reservoir assessment in Dona Ana County, New Mexico: New Mexico Energy Research and Development Institute, NMERDI 2-69-2202, 108p.

Swanberg, C. A., compiler, 1983, Geothermal resources of New Mexico: scientific map series: National Oceanic and Atmospheric Administration in conjunction with New Mexico State University Energy Institute and the U. S. Department of Energy, scale, 1:500,000.

Lohse, R. L., Schoenmackers, R., Gross, J. T., and Whittier J., 1985, Geothermal low-temperature reservoir assessment in northern Dona Ana County, New Mexico: New Mexico Energy Research and Development Institute, NMERDI 2-71-4220, 150p.

Morgan, P., Harder, V., Swanberg, C.A., and Daggett, P. H., 1981, A groundwater convection model for Rio Grande Rift geothermal resources: Geothermal Resources Council, Transactions, v. 5, pp. 193-196.

Reiter, M., Edward, C., Hartman, H., and Weidman, C., 1975, Terrestrial heat flow along the Rio Grande Rift, New Mexico and southern Colorado: Geological Society of America Bulletin, v. 86, pp. 811-818.

Budget Summary

Revised Work Plan

	DOE	NMRDI	EMD	NMSU
Administration	$10,500	$6,500	$1,000	-0-
Personnel Services, Benefits, Travel, Supplies, Telephone, Copying, Mailing				
Report Preparation and Publication	2,000	500	-0-	-0-
Contractual Programs				
NMSU geothermal well	19,970	-0-	-0-	$50,000
Resource mapping	30,000	25,000	-0-	-0-
Reservoir hydrology	17,500	-0-	-0-	-0-
Moderate-to-intermediate temperature reservoir characterization (NMSU well contingency funds)	30,000	-0-	-0-	-0-
Subtotals	$109,970	$32,000	$1,000	$50,000
Total Program Costs		$192,970		
DOE Funds		$109,970		
State Contribution				
Administration and Report Preparation Cost Waiver		$ 8,000		
Contractual Programs		$ 75,000		
Subtotal		$ 83,000		

RESUME

Name: Rudi Schoenmackers

Title: Director, Energy Institute

Address: New Mexico State University Energy Institute
Box 3EI
Las Cruces, New Mexico 88003

Education:
Dipl. phys., Physics, University of Bonn, 1972
Dr. rer. nat., Physics, University of Bonn, 1975
Thesis Title: Investigation of Fission of U-236 and U-238 with the (α,α'f) Reaction: Excitation Functions of the Fission Probabilities and Angular Distributions of the Fission Fragments.

Awards:
1967 Award for outstanding achievement in science
1972 Fellowship for doctoral studies based on academic excellence
1975 NATO fellowship for postdoctoral studies based on academic excellence
1984 Special Award for Energy Innovation, U.S. Department of Energy

Professional Experience:
Employer - New Mexico State University Energy Institute
Period - January 1984 to present
Position - Director

Research on geothermal energy systems: resource assessments, exploration drilling programs, low temperature applications, industry assistance, feasibility studies. Commercialization activities and information dissemination. Principal investigator on several ongoing projects. Administration and management of the Energy Institute program.

Employer - New Mexico Solar Energy Institute, New Mexico State University
Period - September 1979 to December 1983
Position - Head, Wind Energy (April 1981 to December 1983)
Acting Head, Wind Energy (July 1980 to April 1981)
Research engineer (September 1979 to July 1980)

Research work in wind energy: wind resource assessment, wind energy conversion systems design and applications, computer modeling of wind systems, siting of wind turbines, investigation of utility interconnection with wind electrical systems, information dissemination on wind energy, presentations, workshops, and publications.

Research work in small-scale hydro power: resource and site assessments, management of a small-scale hydroelectric demonstration plant in Alamogordo.

Employer - Energy and Minerals Department, State of New Mexico
Period - May 1978 to September 1979.
Position - Energy consultant

Technical review of proposals submitted for funding under the state's Energy Research and Development Program, especially in the areas of solar, wind, and geothermal; program manager for the state's geothermal demonstration program; technical assistance and advice for energy-related projects; review of environmental impact statements; investigation of the feasibility for siting electrical power generating stations in south central New Mexico; information dissemination on energy-related projects.

Employer - Los Alamos Scientific Laboratory
Period - 1975 to 1977
Position - Postdoctoral scientist

Research in experimental nuclear physics: particle-induced fission experiments with Van de Graaf accelerator beam, on-line data acquisition, data evaluation and interpretation, computer programming, work with fast electronics, fission detector development, thin film preparation, publication of research papers, presentation of papers at local and national meetings.

Employer - Institute for Nuclear Physics, University of Bonn, West Germany
Period - 1972 to 1975
Position - Staff member

Research in experimental nuclear physics: experiments on the Bonn isochronous cyclotron accelerator, the 450 MeV proton synchroton, and the 2 GeV electron synchroton accelerator; work on the cyclotron beam and beam handling system; construction of a remote controlled scattering chamber; work with a 3He-gas recycling system; design and implementation of laboratory learning experience for students of medicine and pharmacy; supervision of laboratory courses for 16 students.

Community Involvement:

Fall 1977: New Mexico Solar Energy Association

Work on a computer model to calculate the heat gain and loss of buildings.

Spring 1978: Community Action Program (CAP)

Preparation of blueprints for a solar-tempered community hall in Galisteo, New Mexico. Design of a solar water heating system for the same community hall.

Further Studies:

Independent studies in the areas of solar and wind energy. Attended three-day short course and workshop on terrestrial photovoltaic energy systems in Albuquerque, September 1978.

Languages:

Fluent in English, German; studied Latin, French, and Dutch

Publications:

Schoenmackers, R. 1985. Geothermal applications in remote areas. Solar applications in remote locations workshop. SOLERAS. Las Cruces, New Mexico. To be published.

Schoenmackers, R. 1985. The New Mexico direct use geothermal commercialization program. Sixty-first annual meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, Tucson, Arizona. To be published.

Schoenmackers, R., and Barnett, K. 1983. Tying in to the wind: a wind energy handbook for New Mexico. New Mexico Solar Energy Insitute: Las Cruces, New Mexico.

Schoenmackers, R.; Wrasman, B.; Zwibel, H.; and Hinman, G. 1983. Economics of business investments in renewable energy systems. In Proceedings of the Eighth IASTED International Symposium, Orlando, Florida, November 9-11.

Schoenmackers, R. 1983. "Microcomputer applications for wind energy measurements." In Proceedings of the American Wind Energy Association National Conference and Exposition, San Francisco, California, October 16-19.

Schoenmackers, R. 1983. Microhydro-small but promising. New Mexico Professional Engineer, 35, 6 (June), 4.

Schoenmackers, R., and Risser, V. V. 1983. "Photovoltaic wind systems familiarization computer program." In the Proceedings of the Wind/Solar Energy Conference, Kansas City, Missouri, April 25-26.

Schoenmackers, R. 1983. "SWECS performance data from New Mexico's wind energy research and demonstration program." In Proceedings of the Energy Sources Technology Conference and Exhibition, Houston, Texas, January 30 - February 3.

Schoenmackers, R. 1982. A hydroelectric generator for a municipal pipeline in Alamogordo. In Proceedings of the Fifty-eighth Annual Meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, El Paso, Texas, April 28 - May 1.

Barnett, K., and Schoenmackers, R. 1981. Wind energy in New Mexico. In Proceedings of the Wind Power Energy Alternative for the Midwest Conference, p. 87, April 3-4, Rochester, Minn.

Schoenmackers, R., and Barnett, K. 1981. Wind in New Mexico. Wind Power Digest 22:40.

Schoenmackers, R., and Barnett, K. 1980. The New Mexico wind energy program. Proceedings of the Western SUN 1980 Solar Update, Salt Lake City, Utah, September 25-26, 1980.

Britt, H. C.; Gavron, A.; Goldstone, P. D.; Schoenmackers, R.; Weber, J.; and Wilhelmy J. B. 1978. Yet more complexity in fission: barriers for nuclei with N = 150-154. Phys. Rev. Lett. (USA) 40:1010.

David, P.; Debrus, J.; Lubke, F.; Schoenmackers, R.; and Schulze, J. 1978. The fission processes U-238 (α, α'f) at Eα = 50 MeV and U-235 (d,pf) at E_d = 23 MeV and the total kinetic energy release in fission of excited nuclei. Phys. Lett. B (Netherlands) 77B:178.

David, P.; Bachschi, N. M.; Debrus, J.; Kim, U.; Kumbartzki, G.; Lubke, F.; Mayer, T.; UcKuk, K.; Mommsen, H.; Schoenmackers R.; Speidel, K. H.; and Stein, G. 1977. Investigation of bremsstrahlung-induced reactions in nuclei of masses A=27-238 in the end-point energy range 450 MeV-2.2 GeV. Forschungsber. Landes Nordrhein-Westfalen, no. 2664, p. 1-100.

Goldstone, P. D.; Britt, H. C.; Schoenmackers, R.; and Wilhelmy, J. B. 1977. Determination of μ_n/μ_f at 12 to 20 MeV excitation from evaporation-residue cross sections. Phys. Rev. Lett. 38:1262.

Schoenmackers, R.; Britt, H. C.; Goldstone, P. D.; and Wilhelmy, J. B. 1977. High resolution measurement of the 5.0 MeV sub-barrier resonance in Pu-240 using the Pu-238 (t, μpf) reaction. Bull. Am. Phys. Soc. 22:67.

Gavron, A.; Britt, H. C.; Goldstone, P. D.; Schoenmackers, R.; Weber, J.; and Wilhelmy, J. B. 1977. μ_n/μ_f in heavy actinides. Phys. Rev. C (USA) 15:2238.

Bentheim, F.zu; David, P.; Debrus, J.; Hinterberger, F.; Jahn, R.; Lubke, F.; Mommsen, H.; Schoenmackers, R.; and Schuller, B. 1976. Elastic scattering of α-particles on B-10 for Eα = 5-50 MeV. Z. Phys. A (Germany) 279:163.

David, P.: Debrus, H.; Essen, H.; Lubke, F.; Mommsen, H.; Schoenmackers, R.; and Soyez, W. 1976. Elastic and inelastic He-4 scattering on Pb-208, Th-232, and U-234, 236, 238. Z. Phys. A (Germany) 278:281.

Bachschi, N. M.; David, P.; Debrus, J.; Lubke, F.; Mommsen, H.; and Schoenmackers, R. 1976. Photonuclear reactions in Sc-45 and Cu-nat induced by 2 GeV bremsstrahlung. Nucl. Phys. A (Netherlands) A 264:493.

David, P.; Debrus, J.; Lubke, F.; Mommsen, H.; Schmitt, E.; Schoenmackers, R.; and Simons, H. 1976. Fission of U-238 following inelastic α-particle scattering at bombarding energy E_α = 50 MeV. Phys. Lett. B (Netherlands) 61B:158.

David, P.; Debrus, J.; Lubke, F.; Mommsen, H.; Schoenmackers, R. 1976. Total kinetic energies and mass yield distributions of Cf-252 fission fragments. Phys. Lett. B (Netherlands) 60B:445.

David, P.; Debrus, J.; Lubke, F.; Mommsen, H.; Schoenmackers, R.; and Stein, G. 1974. Bremsstrahlung induced nuclear reactions with E_3^{max} = 450 MeV. Nucl. Phys. A (Netherlands) A 221:145-62.

_____. 1973. High energy photonuclear reactions. Int. Conf. on Photonuclear Reactions and Applications Conf-730301-P2, Pacific Grove, California, March 26, p. 985.

David, P.; Debrus, J.; Kim, U.; Lubke, F.; Mommsen, H.; Schoenmackers, R.; Soyez, W.; Speidel, K. H.; and Stein, G. 1972. High energy photonuclear reactions. J. Phys. (France) 33:18.

Reports:
Geothermal low-temperature reservoir assessment in northern Dona Ana county, New Mexico: final report. New Mexico Energy Research and Development Institute, NMERDI 2-71-4220. December 1984.

Design and construction of a geothermally heated greenhouse research facility. New Mexico Energy Research and Development Institute, NMERDI 2-72-4214. August 1984.

Wind generator for solar office complex, Luna Vocational Technical Institute, Las Vegas, New Mexico: final report. New Mexico Energy Research and Development Institute, NMERDI 2-69-2210. September 1984.

Wind system interconnected with Lea County Electric Cooperative at Lovington, New Mexico: final report. New Mexico Energy Research and Development Institute, NMERDI 2-68-2214. August 1984.

Wind system interconnected with Public Service Company of New Mexico at Deming, New Mexico: final report. New Mexico Energy Research and Development Institute, NMERDI 2-68-2215. August 1984.

Fuel cells for photovoltaic systems applications. Prepared for the Naval Civil Engineering Laboratory. June 1984.

Study for hydraulic power recovery from New Mexico water distribution systems: final report. New Mexico Energy Research and Development Institute, NMERDI 2-71-4223. February 1984.

Llano Estacado wind generator demonstration project: final report. Prepared for the New Mexico State Highway Department by the New Mexico Solar Energy Institute, Las Cruces. July 1983.

Final report: Bonito pipeline study. Prepared for the U.S. Department of Interior, Bureau of Reclamation. May 1983.

Alamogordo hydroelectric project engineering report. August 1981.

Preliminary design of the Llano Estacado wind energy project. June 1980.

Report on the technical and economical feasibility for siting electrical generating plants in the Tularosa Basin. January 1979. Prepared for and submitted to the 1st session of the 34th New Mexico Legislature, Santa Fe, New Mexico.

Presentations/Papers:
December 1984. Geothermal resources in New Mexico. Human Ecology course, New Mexico State University, Las Cruces, New Mexico.

October 1984. The geothermal potential at Holloman Air Force Base. Holloman AFB, New Mexico.

July 1984. The New Mexico geothermal program. Meeting of the El Paso Solar Energy Association, El Paso, Texas.

September 1982. Wind energy in New Mexico. Tenth Annual NMSEA Life Technics Conference, Ghost Ranch, New Mexico.

August 1982. The New Mexico wind energy program. Wind Energy Workshop, Hawaiian Natural Energy Institute, Honolulu, Hawaii.

April 1982. A hydroelectric generator for a municipal pipeline in Alamogordo. Fifty-eighth Annual Meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, El Paso, Texas.

October 1981. Wind energy systems for residential, agricultural, and small industrial applications. Invited guest lecturer for the Wyoming Energy Extension Service at Casper, Wyoming.

July 1981. Wind energy. Summer Science Training Program, New Mexico State University.

April 1981. A small hydroelectric power generator for Alamogordo. Mini Symposium of the New Mexico section of AAIA at Alamogordo, New Mexico.

February 1981. Micro hydro power. New Mexico Solar Energy Institute.

January 1981. Wind energy technology. El Paso Solar Energy Association, El Paso, Texas.

January 1981. Wind energy applications. Alternative Energy/Appropriate Technology Training Workshop, Albuquerque, New Mexico.

October 1980. Wind energy. Energy Forum of the Southern Pueblos Agency, Albuquerque, New Mexico.

September 1980. The New Mexico wind energy program. Western SUN 1980 Solar Update Conference in Salt Lake City.

July 1980. Wind energy. Summer Science Training Program, NMSU.

May 1977. A fission detector for high resolution measurements with the Q3D. Los Alamos Scientific Laboratory.

February 1977. High resolution measurement of the 5.0 MeV sub-barrier resonance in Pu-240 using the Pu-238 (t,pf) reaction. Annual Meeting of the American Physical Society in Chicago.

Spring 1976. A gas scintillation counter for the detection of fission fragments. Los Alamos Scientific Laboratory.

Summer 1975. Angular distribution of the fission fragments from the (α,α'f) reaction on U-236 and U-238. University of Bonn.

Fall 1972. Neutron induced fission of uranium 238. University of Bonn.

Other:
Photography, published in Science, October 13, 1978.

Poster, Wind Energy in New Mexico. Published by the New Mexico Solar Energy Institute in October 1980.

Fact sheet, Wind Power for Homes. Published by the New Mexico Solar Energy Institute in August 1983.

Geothermal Energy in New Mexico. Letter to the editor. Published in New Mexico Business Journal, October 1984.

RESUME

JAMES C WITCHER

1983? what is current status - MSC, etc.?

ADDRESS

P.O. BOX 4747 UPB, Las Cruces, New Mexico 88003
5625 N. Granada #6, Las Cruces, New Mexico 88001
(505) 521-3214

CAREER OBJECTIVES

Exploration geologist, development and execution of exploration programs.

EDUCATION

New Mexico State University, graduate student, 1983
New Mexico State University, BIS, 1977
New Mexico Military Institute, 1967-1969

INTERESTS

Exploration geology and geophysics; geologic mapping; aqueous geochemisty; geothermics and terrestrial heat flow; and regional geology of the southwestern United States

BACKGROUND

Performed temperature logging and measurement of heat flow; planned and supervized drilling of temperature gradient holes; collected and interpreted geochemical information; developed a CO_2-silica geothermometer for low-temperature geothermal investigation; recommended, directed, and interpreted contract geophysical surveys; permitted drilling and geophysical surveys with government agencies; researched geothermal phenomenon in Arizona; coordinated and completed a geothermal resources map of Arizona; generated and organized several geothermal data bases.

EXPERIENCE

Consulting geologist; Stone and Witcher; Tucson, Arizona; 1982-1983.
Geologist; Arizona Bureau of Geology and Mineral Technology, University of Arizona; Tucson, Arizona; 1978-1982.

AWARDS AND HONORS

Letter of commendation, General John Vessey, Commanding General U.S. Army Thailand; letter of commendation, General Jack Albright, Deputy Commander 1ST Signal Brigade, U. S. Army Vietnam; Sigma Gamma Epsilon; session co-chairman, geothermal and hydrothermal systems, Cordilleran section meeting, The Geological Society of America, Hermosillo, Mexico; certificate of appreciation, Arizona Utility Supervisors Association; graduate teaching assistantship, Department of Earth Sciences, New Mexico State University.

RECENT PUBLICATION

Witcher, J. C., Stone, C. and Hahman, W. R., 1982, The geothermal resources of Arizona: National Geophysical and Solar-Terrestrial Data Center, National Oceanic and Atmosphere Administration, in cooperation with the U.S. Department of Energy and the Arizona Bureau of Geology and Mineral Technology, University of Arizona, scale 1:500,000.

PROFESSIONAL AFFILIATIONS

New Mexico Geological Society Geological Society of America Geothermal Resources Council American Geophysical Union Sigma Gamma Epsilon

References and publication list available upon request

PUBLICATIONS

ABSTRACTS

Witcher, J. C. and Stone, C., 1981, Thermal regime of the Clifton-Morenci area, Arizona: Cordilleran section, Geological Society of America Abstracts, v. 13, no. 2, p. 114.

MAPS

Hahman, W. R., Stone, C., and Witcher, J. C., 1978, Preliminary map - geothermal energy resources of Arizona, geothermal map 1: State of Arizona Bureau of Geology and Mineral Technology, scale 1:1,000,000.

Witcher, J. C., Stone, C., and Hahman, W. R., 1982, The geothermal resources of Arizona: National Geophysical and Solar-Terrestrial Data Center, National Oceanic and Atmospheric Administration, in cooperation with the U. S. Department of Energy and the State of Arizona Bureau of Geology and Mineral Technology, University of Arizona, scale 1:500,000.

ARTICLES

Witcher, J. C., 1979, Geothermal space heating and cooling - a direct use of naturally occuring hot water in southern Arizona: Fieldnotes, State of Arizona Bureau of Geology and Mineral Technology, v. 9, no. 4, p. 1-2.

Witcher, J. C., 1980, Geothermal space heating/ cooling: Geo-heat Utilization Center Quarterly Bulletin, Oregon Institute of Technology, v. 5, no. 2, p. 18-20.

Witcher, J. C., 1981, Thermal springs of Arizona: Fieldnotes, State of Arizona Bureau of Geology and Mineral Technology, v. 11, no. 2, p. 1-3.

TECHNICAL REPORTS

Swanberg, C. A., Morgan, P., Stoyer, C., and Witcher, J. C., 1977, An appraisal study of the geothermal resources of Arizona and adjacent areas in New Mexico and Utah and their value for desalination and other uses: New Mexico Energy Institute Technical Report 6, New Mexico State University, 76 p.

Witcher, J. C., 1979, A progress report of geothermal investigations in the Clifton area:

State of Arizona Bureau of Geology and Mineral Technology Open-File Report 79-1b, 16 p.

Witcher, J. C., 1979, A geothermal reconnaissance study of the San Francisco River between Clifton, Arizona and Pleasanton, New Mexico: State of Arizona Bureau of Geology and Mineral Technology Open-File Report, 18 p.

Witcher, J. C., 1979, Geothermal potential of the IBM plant site area, Tucson, Arizona: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 79-18, 26 p.

Witcher, J. C., 1979, A preliminary report on the geothermal energy potential of the Safford basin, southeastern Arizona: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 79-2c, 31 p.

Witcher, J. C., 1979, A preliminary study of the geothermal potential of the Tucson metropolitan area: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 79-2d, 19 p.

Witcher, J. C., 1979, Geothermal resource assessment of the Safford-San Simon basin for geothermal desalination: State of Arizona Bureau of Geology and Mineral Technology Open-File Report, 40 p.

Witcher, J. C., 1979, Proven, potential and inferred geothermal resources of Arizona and their heat contents: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 79-5, 65 p.

Witcher, J. C., 1980, Proven, potential and inferred geothermal resources of Arizona and their heat contents, in Powell, W. and Tang, K. eds., Geothermal direct heat use: Market potential - penetration analysis for federal region IX: Jet Propulsion Laboratory, JPL Publication 80-41, Paasadena, California, p. A3 - A73.

Witcher, J. C. and Stone, C., 1980, Heat flow and the thermal regime in the Clifton, Arizona area, State of Arizona Bureau of Geology and Mineral Technology Open-File Report 80-1a, 29p.

Witcher,J. C., 1981, Thermal springs of Arizona, in Ruscetta, C. A. and Foley, D., eds., Geothermal Direct Heat Program Glenwood Springs Technical

Conference Proceedings, Volume 1: Earth Science Laboratory University of Utah Research Insitute, Salt Lake City, Utah, ESL Report 59, p. 78-89.

Witcher, J. C., 1981, Geothermal resource potential of the Safford-San Simon basin, Arizona: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 81-26, 125p.

Witcher, J. C., 1981, Geothermal energy potential of the lower San Francisco River region, Arizona: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 81-7, 141p.

Witcher, J. C., 1982, Geothermal resource potential of the Tucson basin, Arizona: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 82-3, 49p.

Witcher, J. C., 1982, Geothermal resource potential of the Willcox, Arizona area: State of Arizona Bureau of Geology and Mineral Technology Open-File report 82-4, 40 p.

Witcher, J. C., 1982, Exploration for geothermal energy in Arizona basin and range: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 82-5, 51 p.

Witcher, J. C., 1982, Exploration for geothermal energy in Arizona basin and range, in Ruscetta, C., ed., Geothermal Direct Heat Program Roundup Technical Conference Proceedings, Volume 1: Earth Science Laboratory, University of Utah Research Institute, Salt Lake City, Utah, p. 33- 61.

Stone, C., and Witcher, J. C., 1982, Geothermal energy in Arizona - final report: State of Arizona Bureau of Geology and Mineral Technology Open-File Report 83-12, 398 p.

Witcher, J. C., and Stone, C., 1983, A CO2 - Silica geothermometer for low temperature geothermal resource assessment, with application to resources in the Safford Basin, Arizona: Stone and Witcher consulting geologists, prepared for Arizona Solar Energy Commission and U. S. Department of Energy, 91 p.

CONSULTING

IBM Corporation Tucson, AZ	assistance in feasibility study of geothermal space heating and cooling of the Tucson facility.
Jim Richardson Healdsburg, CA	suitable geothermal resource for shrimp aquaculture.
Decker Land Tucson, AZ	assistance in feasibility study for geothermal heat in a large hotel/apartment complex.
Manera, Inc. Phoenix, AZ	temperature logging of problem municipal water wells in Mesa, AZ.
Randy Gose Silver City, NM	evaluation of gold properties and expert testimony in Federal land condemnation proceedings (client awarded full claim).
Phelps Dodge Corp. Morenci, AZ	assistance in evaluation of ground water in the Eagle Creek and Blue Range region, Arizona.
Geo-Agr-Tech Tucson, AZ	suitable resources for greenhouses.
Dr. Randy Keller, UTEP and Texaco, Inc. Advanced Exploration Division Houston, TX	led a portion of a field trip in the Rio Grande rift, West Texas, New Mexico.
Safford Federal Prison Safford, AZ	assistance in feasibility study of geothermal space heating of prison.
U.S. Department of Energy and AZ Solar Energy Commission Phoenix, AZ	developed a new CO2-silica geothermometer.
Trans-Pacific Geothermal Oakland, CA	geothermal lease evaluation and recommendation on lease acquisition or retention.

RESUME

Name: John P. Whittier

Title: Project Manager

Address: New Mexico State University Energy Institute
Box 3EI
Las Cruces, New Mexico 88003
(505) 646-1747

Education:
B.A., History, St. Lawrence University, 1975
M.A., Technology and Human Affairs, Washington University, 1978
M.B.A. (candidate), New Mexico State University

Experience:
Employer - New Mexico State University Energy Institute
Period - 1982 to present
Position - Project Manager

Buffalo Gourd: Its Potential as an Ethanol and Diesel Fuel Feedstock in New Mexico. A technical and economic feasibility analysis of growing buffalo gourd (Curcurbita foetidissima HBK) for production of ethanol and seedoil.

Use of Saline Water for Buffalo Gourd Production in New Mexico. Buffalo gourds are being grown for evaluation of plant growth characteristics in response to different salinity levels.

New Mexico Solar Home Temperature Survey. Forty passive solar homes are being monitored for maximum and minimum temperatures for a one year period. Energy performance and thermal comfort characteristics are compared.

Assessment of Organic Wastes in New Mexico with a Potential for Energy Production. Preparation of an inventory of organic wastes in New Mexico. Responsible for program management, data collection, and report preparation.

Statewide Geothermal Temperature Gradient Hole Drilling Program. Identification of sites for commercialization of geothermal technology. Activities include geological and geophysical analysis, regulatory compliance, and financial evaluation for a variety of private and public sector clients.

New Mexico Geothermal Commercialization Project, Groundwater Hydrology. Supervision of project to define the extent of the Las Cruces East Mesa Geothermal Field. Groundwater tracing technique involving the measurement of the concentration of naturally occurring uranium isotopes.

An Evaluation of Thermal Remote Sensing as a Low-Cost Regional Geothermal Exploration Technique in New Mexico. Reponsible for project supervision and final report preparation. Project evaluated technical and economic feasibility of using aerial and satellite acquired thermal data for regional geothermal exploration in New Mexico.

Preliminary Evaluation of Geothermal Energy Development by the City of Las Cruces. Several stage project to evaluate technical and economic feasibility of district heating and industrial park heating with geothermal fluids.

Employer - Xenergy, Inc., Burlington, Massachusetts
Period - 1980 to 1981
Position - Engineer/Economist

Energy Sales Forecasting, Commercial Sector. Creation of an end use energy consumption data base for the commercial sector. Data base included floorspace estimates by SIC code, fuel market shares, energy usage by end use for eight SIC categories and projections of future end use patterns using computer building simulation. Development of creative technology/cost relationships for retrofit conservation analysis.

Energy Conservation Feasibility Studies. Evaluation of energy conservation options for commercial buildings. Projects included technology review and financial analysis of HVAC, lighting, control systems, and solar applications.

Commercial and Apartment Conservation Service. Development of Rules and Regulations for Federal initiative to mandate utility-sponsored energy conservation programs for commercial sector buildings.

Employer - Lawrence Berkeley Laboratory
Period - 1978 to 1980
Position - Staff Scientist

Appliance Energy Efficiency Standards, Assistant Principal Investigator
Building Energy Performance Standards, Assistant Principal Investigator
Active Solar Cooling Commercial Readiness Assessment
Distributed Energy Systems in California's Future
Consumer Decision Making

Employer - Consultant
Period - 1976 to 1978
Position - Consultant. Clients included SRI, International (Menlo Park, California), California Energy Commission (Sacramento, California), the Missouri Department of Natural Resources (Jefferson City, Missouri), Lawrence Berkeley Laboratory (Berkeley, California), and DHR, Inc. (Washington, D.C.)

Additional Energy Projects:

Municipal wind, cogeneration feasibility studies, (IPSWICH)
Industrial Technology Trust Fund, (DHR)
Synthetic Fuels Net Energy Analysis, (DHR)
The Potential for Energy Conservation and Renewable Energy Sources: St. Louis Case Study (SRI)

Areas of Knowledge:

Municipal energy development financing; commercial and residential energy management; renewable energy technology (geothermal, solar, wind, and bio-mass) feasibility studies; energy market research, forecasting, and evaluation; energy policy analysis.

Professional Societies:
American Association for the Advancement of Science
American Solar Energy Society
Geothermal Resources Council

Publications and Reports:

Goldstein, B.; Schultz, E.; Lessman, K.; Finkner, R.; DeVeaux, J.; Carr, P.; Darby, W.; Whittier, J.; 1985. "Technical and Economical Feasibility of Buffalo Gourd as a Novel Energy Crop," New Mexico Solar Energy Institute, 2-72-4213, Las Cruces, New Mexico

Gross, J.; Cochran, J.; Icerman, L.; and Whittier, J., 1985. "Uranium Disequilibrium Investigation of the Las Cruces East Mesa Geothermal Field," New Mexico State University Energy Institute, 2-67-2238(3), Las Cruces, NM.

Inglis, M.; Budge, T.K.; and Whittier, J., 1985. "An Evaluation of Thermal Remote Sensing as a Low-Cost Regional Geothermal Exploration Technique in New Mexico," New Mexico State University Energy Institute, 2-71-4221, Las Cruces, NM.

Goldstein, B.; Lansford, R.; Whittier, J.; Creel, B. J.; Mapel, C.; Icerman, L. "An Assessment of Organic Wastes in New Mexico with A Potential for Energy Production." New Mexico Solar Energy Institute, 2-71-4237, Las Cruces, New Mexico, 1984.

Meier, A. K., and Whittier, J. "Consumer Discount Rates Implied by Purchases of Energy-Efficient Refrigerators." Energy, 8, 957-62, December 1983.

Icerman, L., and Whittier, J. A Preliminary Evaluation of Geothermal Energy Development by the City of Las Cruces. New Mexico State University Energy Institute, Las Cruces, NM, November 1983.

Icerman, L., and Whittier, J. "Leasing of Public Lands for Direct-Use Geothermal Energy Projects." Geothermal Resources Council Bulletin, 12, November 1983.

Whittier, J., and Icerman, L., 1983. "Leasing of Federal Surface Lands for Direct-Use Geothermal Energy Developments." New Mexico State University Energy Institute, 2-67-2238 (1), Las Cruces, NM.

Whittier, J., 1982. Energy Conservation Study of the Massachusetts Bay Transportation Authority. MBTA Advisory Board, Boston, MA.

Meier, A., and Whittier, J., 1982. "Consumer Purchases of Energy Efficient Refrigerators and Implied Discount Rates." LBL-14924, Lawrence Berkeley Laboratory, Berkeley, CA.

Whittier, J.; Goldish, J.; and Michaels, H.; 1981. Development of an Energy End Use Data Base for the Commercial Sector: New England Electric System. Xenergy, Burlington, MA.

Yen, W. S.; Chambers, D. M.; Elliott, J. F.; Whittier, J. P.; Schnoor, J. J., and Blachman, S.; 1980. A Program Planner's Guide to Geothermal Development in California. Lawrence Berkeley Laboratory, Berkeley, CA.

Whittier, J., 1979. Appliance Energy Use. Lawrence Berkeley Laboratory, Berkeley, CA.

Levine, M. and Whittier, J., 1978. The Potential for Energy Conservation and Renewable Resources: St. Louis Case Study. SRI, International, Menlo Park, CA.

Whittier, J., 1978. Benefit-Cost Analysis of Small-Scale Wind Machines in California. California Energy Commission, Sacramento, CA.

Whittier, J., and Fisher, W., 1977. Solar Energy in Missouri. Missouri Department of Natural Resources, Jefferson City, MO.

Whittier, J.; Fisher, W.; and Jurkiewicz, W.; 1977. "Energy Conservation Through Mandatory Building Codes: The Potential for Missouri." Proceedings of the 4th Annual UMR-DNR Conference on Energy, Rolla, MO.

Whittier, J., 1977. Energy Conservation in Missouri. Unpublished Master's thesis, Washington University, St. Louis, MO.

ANIMAS

STATEWIDE GEOTHERMAL ENERGY PROGRAM FOR NEW MEXICO

Reprogramming of Funds under
Grant No. DE-FG07-84ID12546

Second Addendum to the November 1985
Request Submitted to the U.S. Department of Energy
Idaho Operations Office

by

New Mexico Research and Development Institute
1220 South St. Francis Drive
Pinon Building, Suite 358
Santa Fe, New Mexico 87501

Larry Icerman
Principal Investigator

June 1986

Background

A request for reprogramming of funds under U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12546 was submitted by the New Mexico Energy Research and Development Institute in November 1985 to make funds available to carry out three new program opportunities: (1) resource mapping; (2) reservoir hydrology; and (3) engineering assistance. Verbal approval from DOE was received for the work proposed in principle under items (1) and (2). The engineering assistance activities were judged to not be an appropriate reprogramming of funds.

In response to the request made by DOE, this addendum, submitted by the New Mexico Research and Development Institute (NMRDI), contains a more detailed work plan associated with the reservoir hydrology activities suggested and approved in principle earlier. Also included is a proposed revised budget and resumes of the individuals who will carry out the work on a day-to-day basis. A 12-month no-cost extension of the performance period for Grant No. DE-FG07-84ID12546 is requested to cover fully the proposed work period for the reprogrammed activities.

Reservoir Hydrology

Introduction

The Animas Valley is located in Hidalgo County in southwestern New Mexico. This area has been known to contain anomalously high subsurface temperatures for many years and was designated as a Known Geothermal Resource Area (KGRA), with the name of Lightning Dock, by the U.S. Geological Survey in 1974. Three commer-

cial users of the geothermal resources are presently in place. Numerous temperature gradient wells have been drilled in the Valley in an effort to define the extent of the resource base. Fourteen shallow production wells have been drilled to support the commercial users, 12 of which are currently accessible. The anticipated rapid expansion of commercial direct-use applications in the Animas Valley area forms the basis for concern regarding the near-surface hydrology of the intermediate temperature reservoir and the relationship between this resource and the potential electrical-grade resource known to exist at only slightly greater depths.

An electrical-grade geothermal prospect is located at the Lightning Dock Geothermal, Inc. (LDG) leases in the Animas Valley. These leases originally were farmed to AMAX, Inc. In turn, the exploration operations conducted to date were directed by Steam Reserve Corporation (SRC), a wholly-owned subsidiary of AMAX. A deep exploratory well to 7,100 ft was completed by SRC in February 1985 at a cost of about $1.45 million. Because the well failed to flow live steam, together with lack of progress in other areas, AMAX discontinued geothermal operations, reverting the leases to the original owner.

The exploratory well (55-7) produced evidence of 300 ^{o}F fluids producible from depths shallower than 2,000 ft. Geophysical logs indicate substantial production rates are possible from the fractured formation at 1,350 to 1,650 ft. The deepest of the production wells in the general vicinity used for space heating is completed to 550 ft and produces 245 ^{o}F fluid.

A thorough and systematic evaluation of the reservoir hydrology has not been performed for the local geothermal anomaly. Accurate evaluations of disposal or re-injection options, production drawdown rates, and reservoir life are yet to be made and have an important impact on well completion designs. Likewise, no data are available from the existing production wells on drawdown, recharge, or other facts needed to establish safe formation yield information.

The first known study of the hydrology of the Animas Valley was performed by Schwennesen (1918). A recent comprehensive study of the local geology, including some hydrologic data and interpretations, has been prepared by O'Brien and Stone (1984). The boundaries of a thick saturated interval of unconsolidated sediments were postulated by this work on the basis of hydrologic data, seismic refraction profiles, gravity data, geology, and well logs. Recharge to the groundwater system in the valley occurs from irrigation return flow, underflow from adjoining basins, and precipitation. Irrigation return flow, as inferred from water level fluctuations by Reeder (1957), is a small contributor to the total recharge. Underflow is not well quantified. The annual precipitation of approximately 10 inches in the lower Animas Valley does not add significant quantities of water to the groundwater system, while rainfall in the upper Animas Valley and on the adjacent mountainous areas does contribute in a major way to the groundwater system (Reeder, 1957).

Transmissivity values of 22,000 to 246,000 gal/d-ft with an average value of 50,000 gal/d-ft are reported by Reeder (1957).

Summers (1967) analyzed water level changes and pumping rates in the lower Animas Valley and determined to the average local transmissivity to be 61,700 gal/d-ft.

Hydrological evaluations by O'Brien and Stone (1984) of the entire Animas Valley provide regional background data but, unfortunately, were based primarily on records in the public domain of shallow irrigation wells of high water quality, few of which exhibit any evidence of a thermal anomaly. In contrast, the area of T24S, 19W, Section 7 has a pattern of shallow anomalously warm wells with temperatures near to above the boiling point of water. Summers (1967) suggested that this localized high-temperature regime was the result of dilution of very high temperature reservoir fluids by shallow, cold groundwater moving north at a fairly rapid rate past a stationary heat source.

Koenig and Gardner (1974) concluded that an intrusive heat source is present, with heat leakage being guided by faults in the basin area. Intersections of thrust faults at depth with younger faults may serve to control the reservoir. Layered, fractured sedimentary and volcanic rocks away from the crystalline bodies constituting the basin-bounding mountain ranges should be the host for the thermal anomaly (Koenig and Gardner, 1974).

A detailed mathematical model of the hydrological conditions of the Animas Valley, including information obtained from a number of geothermal investigations, was prepared with the support of DOE by Hawkins and Stephens (1982). Unfortunately, changes in the agricultural practices in the Valley since 1982

may well have made the results of this study to a large extent of historical value only.

Research Design

A comprehensive hydrological survey is proposed, which will map the boundaries of the geothermal anomaly by means of water levels, water chemistry, and temperature. New data collected over a continuous 12-month period will be analyzed in the context of the large quantity of proprietary data available from prior AMAX and Steam Reserve Corporation work. These latter data are available to the proposed research team. Results from the synthesis of the existing secondary data in the public domain, the primary data to be obtained as part of this project, and the data previously held as confidential will be used for the interpretations of the hydrological conditions in the Animas Valley.

Work Plan

The proposed work will be conducted as five major tasks. The results of each of these tasks will be synthesized to provide a detailed hydrological assessment of the Animas Valley focused on the known geothermal anomaly in the area.

Task 1: Review and Evaluate Existing Hydrological Data. All data and reports available in the public domain will be acquired and evaluated. The types of information available include regional geological and hydrological reports from the U.S. Geological Survey and the New Mexico Bureau of Mines and Mineral Resources. Public domain data will be reinterpreted using the now available, but previously proprietary, data, which include significant data on subsurface conditions and data from Well 55-7.

In the study area, detailed water chemistry analyses, temperature surveys, or hydrographic data are available for about 60 irrigation wells. In addition, proprietary water chemistry and temperature surveys have been completed for 12 shallow geothermal wells. Detailed drawdown analyses have not been performed to determine the drawdown due to geothermal fluid extraction or to determine any potential communication between geothermal and irrigation wells. Temperature, mineral content, and water level have not been evaluated systematically for these 72 wells.

Task 2: Field Work. The field work will be based on a representative sample of the 72-well population. Well selection will be based on a review of available data and a sampling distribution to assure areal coverage. A total of nine irrigation wells and three geothermal wells will be used as controls for the field work. Measurements and samples will be acquired at least monthly for each of these 12 wells. Data will be evaluated to determine seasonal effects in all four seasons, which encompass a full range of values for irrigation, precipitation, and geothermal use.

Task 3: Water Quality Analysis. Based on a review of data compiled in Task 1, nine candidate irrigation wells and geothermal wells will be selected for initial analysis. Two of these irrigation wells and three geothermal wells will be sampled and analyzed during each of the remaining three climatic seasons. All of the primary data collected (i.e., 27 data points) will be interpreted in the context of the existing proprietary data base containing more than 60 complete chemical analyses.

Task 4: Temperature Surveys. A precision temperature survey will be run on each of the 12 shallow geothermal production wells on a monthly basis. Two of the 14 shallow production wells are currently unaccessible.

Task 5: Hydrograph Surveys. For a minimum of two of the irrigation wells and for two of the geothermal wells, precision drawdown measurements will be taken on a minimum of a monthly basis. A stainless steel drawdown tube will be inserted in each well. The tubing will be charged with nitrogen, and the water depth will be measured using a high-precision Heise gauge. Where accessible, water-level measurements will be made for other sample irrigation wells.

Deliverables

A detailed final technical report will be prepared for submission to DOE. The report will describe all data tables, charts, methods of research, and data reduction. The report will also discuss interpretations of the hydrological information. A complete bibliography of data sources and references will be included in the report. The proprietary data made available by Lighting Dock Geothermal to this project will also be made available as part of the final technical report.

Research Staff

Roger Bowers, Vice President of Lighting Dock Geothermal, will supervise and conduct the work related to geothermal evaluations and analysis. Mr. Bowers is a widely recognized geologist in the geothermal energy community. He has served as the Geothermal Program Manager for Hunt Energy Corporation for the past

12 years. Mr. Bowers directed the extensive geothermal exploration effort by Hunt Energy Corporation in Dona Ana County, New Mexico, in 1982-83. Mr. Roy Cunniff, President of Lightning Dock Geothermal, will supervise and conduct the engineering aspects of the evaluation and analysis. Mr. Cunniff was the Project Engineer for the highly successful New Mexico State University Campus Geothermal Project. That project included drilling a new production well, an observation well, and a new disposal well. As Project Engineer for the San Bernardino geothermal system, Mr. Cunniff was responsible for the drilling program, in which two deep gradient wells of 1,380 and 1,985 ft were drilled and one new production well was completed in early September 1984. Mr. Cunniff also was the head of the engineering team that conducted a reservoir assessment of the Radium Springs, New Mexico, geothermal field in May 1983 (see attached resumes). A senior consulting hydrologist will be hired to provide the research team with the necessary hydrology experience. This individual will assist in the design and execution of the entire research program, with his or her efforts concentrated on Tasks 2, 3, and 5, as well as on the synthesis and interpretation of the data in the final technical report. Discussions have been initiated with a number of qualified hydrologists; however, the selection process has not yet been completed.

Company Profile

Lightning Dock Geothermal, Inc. was founded as a partnership in early 1986 to purchase the federal geothermal lease and Well 55-7 in the Animas Valley. Under the terms of the Partnership

Agreement, the General Partner is Roy Cunniff. The other partners are Oliver Grace, President of Geothermal Properties, Inc., a New York company; Ronald Barr, President of Yankee Petroleum of Tulsa, Oklahoma, which among other assets owned a substantial share of the producing geothermal steam field at Steamboat Hot Springs, Nevada; and Roger Bowers.

The firm is in process of incorporation in New Mexico. Roy Cunniff has been designated President, Roger Bowers has been designated Vice-President, and Ronald Barr has been designated Secretary-Treasurer. Oliver Grace has been designated a board member. These four principals sit as the Board of Directors.

Company Contribution

Lightning Dock Geothermal will contribute $48,750 of direct expenditures to further the work proposed (see attached letter). These funds will support the completion of a site-specific geological and engineering feasibility analysis for electrical-grade geothermal energy development in the Animas Valley. The geological and geophysical evaluations will include previously proprietary data from a series of 63 shallow (i.e., 100-meter) and four intermediate-depth (i.e., 300-meter) temperature gradient wells. Included also will be a reinterpretation of studies previously conducted in the Animas Valley that are in the public domain. The engineering analysis will include detailed site-specific assessments of alternative binary-cycle wellhead electricity generation systems designed for use in the Lightning Dock geothermal area. Evaluations of performance, reliability, costs, and efficiency for equipment provided by competing manufacturers

will be included. The analysis will also evaluate geothermal effluent disposal options.

Program Organization

Larry Icerman, NMRDI Acting Director, will continue to serve as the Principal Investigator of the revised research program. Dr. Icerman has been actively involved in geothermal energy development in New Mexico since 1980 and has been Principal Investigator for more than 20 geothermal research, development, and commercialization projects valued at over $1.5 million. He has extensive management and field experience in geothermal drilling programs in New Mexico and is the editor, co-editor, author, or co-author of more than 30 papers and reports on geothermal energy exploration and development.

Program Duration

A 12-month period is proposed to conduct the reprogrammed work plan. This schedule will allow adequate time to prepare a contract for the reservoir hydrology work, to complete the proposed analysis and field activities, while still leaving sufficient time to interpret and report on the results. A 12-month no-cost time extension for the performance period of Grant No. DE-FG07-84ID12546 is requested from September 30, 1986, to September 30, 1987, in order to complete the reprogrammed research plan.

Deliverables

The results of all of the work conducted under Grant No. DE-FG07-84ID12546 will be reported on in the form of a comprehensive final technical report. This report will be edited by Larry Icerman. Public dissemination of the information will be provided through the established NMRDI information dissemination program. This effort distributes approximately 5,000 copies of research and development reports annually.

Budget

The revised budget detail outlines the commitment and expenditure of funds under this addendum. Substantial administrative costs will be borne by NMRDI. The State of New Mexico considers administrative costs to be a contribution not a match. The monies provided by Lightning Dock Geothermal for the preparation of the geological and engineering feasibility study are also considered to be a contribution.

References

Hawkins, D.B. and Stephens, D.B., 1982, Hydrologic study of the Animas Valley-Lightning Dock KGRA areas, in L. Icerman and A. Starkey, eds., State-Coupled Low Temperature Geothermal Resource Assessment Program, Fiscal Year 1981: New Mexico Energy Institute at New Mexico State University, pp. 8/1-8/93.

Koenig, J.B. and Gardner, M.C., 1974, Geology of the Animas Valley, New Mexico: GeothermEx, Inc., 46 p.

O'Brien, K.M. and Stone, W.J., 1984, Role of geological and geophysical data in modeling a southwestern alluvial basin: Groundwater, v. 22, no. 6, pp. 717-727.

Schwennesen, A.T., 1918, Groundwater in the Animas, Playas, Hachita, and San Luis basins, New Mexico: U.S. Geological Survey, Water Supply Paper 422, 152 p.

Summers, W.K., 1967, A comparison of long-term and short-term pumping tests: Groundwater, v. 5, no. 3, pp. 33-34.

Budget Summary

Revised Work Plan

(Second Addendum)

	DOE	NMRDI	EMD	NMSU	LDG
Administration	$10,500	$6,500	$1,000	-0-	-0-
Personnel Services, Benefits, Travel, Supplies, Telephone, Copying, Mailing					
Report Preparation and Publication	2,000	500	-0-	-0-	-0-
Contractual Programs					
NMSU geothermal well	19,970	-0-	-0-	$50,000	-0-
Resource mapping	30,000	25,000	-0-	-0-	-0-
Reservoir hydrology	47,500	-0-	-0-	-0-	$48,750
Moderate-to-intermediate temperature reservoir characterization (NMSU well contingency funds)	-0-	-0-	-0-	-0-	-0-
Subtotals	$109,970	$32,000	$7,000	$50,000	$48,750
Total Program Costs		$241,720			
DOE Funds		$109,970			
State Contribution					
Administration and Report Preparation Cost Waiver		$ 8,000			
Contractual Programs		$ 75,000			
Lightning Dock Geothermal Contribution		$ 48,750			
Total Contributions		$131,750			

Lightning Dock Geothermal Inc.

June 23, 1986

Larry Icerman, Director
New Mexico Research and Development Institute
1220 South St. Francis Drive
Pinon Building, Room 358
Santa Fe, New Mexico 87501

Dear Larry,

Forwarded in response to your request of June 20, 1986, is our pledge of financial contributions to this project.

As we have proposed, we will provide contributions of work and services valued at $48,750. This expenditure includes office expenses, costs for the equipment to perform detailed temperature and hydrological surveys, travel and subsistence, and professional staff time. These cost elements will be expended to prepare the detailed engineering and geological feasibility report to accompany the proposed hydrological study.

In addition, we will provide an indirect contribution consisting of our annual lease rental of $5,200, and our Federal Lease Bond of $10,000. Our total contribution to this project has a value of $63,950.

We understand that the Federal contribution to this project is our proposed budget of $ 47,040.

Thank you for your continued interest and support. I hope this letter meets your requirements.

Sincerely,

Roy A. Cunniff
Roy A. Cunniff,
President

Roy A. Cunniff

EDUCATIONAL BACKGROUND

M.S. in Mechanical Engineering, New Mexico State University, Las Cruces, New Mexico. (Major Interest: Alternative Energy) 1959-61.
B.S. in Chemical Engineering, University of Colorado, Boulder, Colorado, with minor in Business, 1952-57.
U.S. Army War College, Carlisle Barracks, Pennsylvania. Course work equivalent to MA 1975-76.
Defense Management School, Monterey, California, 1971.
U.S. Army Command and General Staff College, Ft. Leavenworth, Kansas, 1967-68.

EXPERIENCE

October 1985 - Present: Senior Design Engineer for geothermally heated dehydration plant, Animas, New Mexico. Work includes designing geothermal system (245 - 280 °F), dehydration and support buildings, and all related facilities. Project is $850,000 construction project.

May 1985 - Present: Project Director and Senior Engineer for the Raton Cogeneration Project, which includes designing the steam power plant modifications, building retrofit, and the hot water distribution system to service the District Heating System.

March 1985 - Present: Senior Design Engineer for a geothermally heated research greenhouse on NMSU campus. Project cost is $500,000, and includes wells, greenhouse heating and cooling, site work, buildings, greenhouse structure, controls, and environmental considerations.

February 1985 - Present: Project Director and Senior Engineer for a design project to design construction retrofit of eighteen County of San Bernardino buildings for geothermal usage. Project cost is $1.2 million.

July 1983 - Present: Principal Investigator for a $200,000 project to drill a deep (1500 feet) geothermal test well on the NMSU Campus. Work includes a comprehensive program of water chemistry analyses, electrical resistivity, conductivity, soil gas analyses (helium) and reflection seismic surveys, together with the design and supervision of the test drilling. Well currently is 975 feet deep. Drilling to resume in March, 1986.

May 1983 - Present: Principal Investigator and Consultant to Hunt Energy Corporation for a $200,000 project to conduct controlled test pumping, reservoir engineering, and environmental assessments of a moderate temperature geothermal resource (225°F) at Radium Springs, New Mexico.

December 1982 - October 1984: Project Engineer and consultant to the City of San Bernardino, California for a $5.3 million geothermal direct use project. Work included preparing 5-year Disposal Plan for fluoride-laden geothermal effluent, as well as designing and drilling geothermal wells. Work also included designing geothermal retrofit for some 60 buidings, and pipeline system totalling 50,000 feet of pipeline.

February 1979 - June 1983: Project Director and Chief Project Engineer on a project to design and construct a geothermal direct use system on the NMSU campus to heat 30 buildings. Work involved establishing a new geothermal field, and installing a system to use the geothermal energy. Project cost was $1,570,000. Construction started 1 July 1981, and was completed in February 1982, followed by one year of monitoring. Project includes wells, pumps, heat exchangers, 4 miles of pipeline, and hot water storage tank. Project selected for National Award for Energy Conservation, 1985.

June 1978 - Present: Geothermal Engineering Group Leader, Physical Science Laboratory, working on DOE Regional Geothermal Assessment Program, DOE Contract ET-78-S-07-1756. Work entailed analysis of engineering, geophysical, and economic aspects of geothermal energy in ten U.S. western states. From this work, a sophisticated computer simulation program was developed which permits the engineering/economic assessment of geothermal energy for electrical, direct use, and desalinization projects in more than 2,000 different applications.

September 1977 - March 1978: Senior Mechanical Engineer for Lockheed Electronics Company at White Sands Test Facility in R&D programs for Space Vehicle engines. Includes working experience with hypergolic fluids, cryogenics, heat exchangers, high pressure helium, nitrogen, steam, and ultra clean fluids.

1976-77: Project Manager M113 Personnel Carrier, U.S. Army Tank Automotive Command, Warren, Michigan. Supervised 35 logistics, R&D and financial personnel. Overall administrative Control of $450,000 operating budget. Administered contracts with average annual expenditures of more than $300 million, to more than 220 separate firms. Established and administered R&D program of $12.0 million. Work required preparation of frequent progress reports and oral briefings. Daily contact with senior government officials and business representatives. Prepared detailed cost analyses to study alternatives to comprehensive system changes.

1957-77: Active US Military Service, with assignments ranging from company commander thru battalion commander, and leadership and management experience at all levels of staff and command. Specialties were US Department of Army Project Manager's Program, and Logistic Officer's Program. Assignments emphasized engineering and financial management skills.

SYNOPSIS

25 years R&D as engineer and middle manager on geothermal systems, missile systems, infra-red suppression, high altitude simulation for rocket engines, instrumentation, heat exchangers, hypergolic and cryogenic fluids, thermal effects of solar radiation. Work included test planning, test conducting, report preparation..

RECENT PUBLICATIONS

Geothermal Potential Applications for the Rocky Mountain Basin and Range Region, Draft Special Data Report, Roy Conniff, C.R. Rao, Patrick O'Dea, John Perkins, Gary Glazner, Michael Shales, & Roy Heath, New Mexico State University, June, 1979, NMEI 10-6.

Geothermal Potential of Montana, an Economic Alternative to Conventional Energy, Roy Cunniff, C.R. Rao, Kenneth Nowotny, Gary Glazner, Keith Brown, New Mexico State University, July 1979, NMEI 10-7.

Geothermal Market Penetration Assessment for Colorado, New Mexico, Montana, Roy A. Cunniff and C.R. Rao, New Mexico State University, July, 1979, NMEI 30-2.

Geothermal Prospects for Urban Development Action Grants UDAG, Roy A. Cunniff, Gary Glazner, Patrick O'Dea, Dave Gose, Mark Houldsworth, Michael Shales, Roy Heath, Steven Bybee, September, 1979, NMEI 30-3.

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Geothermal Prospects for Lemmon, South Dakota, Roy A. Cunniff, Gary Glazner, Mark Houldsworth, NMEI 30-6.

Data Report Sample NMEI Data Formats, Roy Cunniff, et al., September, 1979, NMEI 30-7.

NMEI Presentation to Jackson Hole Conference, Roy Cunniff, et al., September, 1979, NMEI 30-8.

Increased Investment Tax Credits on Geothermal Development, Roy Cunniff, et al., October, 1979, NMEI 30-9.

Geothermal Potential Direct Use Rocky Mountain Basin and Range 10 States, Roy A. Cunniff, Gary Glazner, Pat O'Dea, April, 1980, NMEI 30-21.

User's Guide to Btherm, Roy Cunniff, et. al., May, 1980, NMEI 30-22.

Geothermal Potential of White Sands Missile Range, New Mexico, a Geophysical, Engineering and Economic Analysis, Roy A. Cunniff, Chandler Swanberg, Keith Brown, New Mexico State University, 28 March 1980, NMEI 57.

New Mexico State University Campus Geothermal Demonstration Project (an Engineering Construction Design and Economic Evaluation) Final Technical Report, Roy A. Cunniff, et al, NMSU, July 1981.

New Mexico State University Geothermal Production Well Completion and Testing, Technical Completion Report, Roy A. Cunniff, et al., NMSU, September 1981.

Geothermal Well Driller's Guide, in press for New Mexico Energy and Minerals Department, Roy A. Cunniff, PSL, September 1981.

New Mexico State University Geothermal Reinjection Well Completion and Testing, Technical Completion Report, Roy A. Cunniff et al., February 1983.

Feasibility of Geothermal Direct Use Application in San Bernardino, Roy A. Cunniff et al., February 15, 1983.

New Mexico State University Geothermal Demonstration Project Final Report, in press for the U.S. Department of Energy and New Mexico Energy and Minerals Department, Roy A. Cunniff et al., June 1983.

Geothermal and Cogeneration Feasibility Analysis for Loma Linda, California, Roy A. Cunniff, Physical Science Laboratory, New Mexico State University, November 1985.

RPSC Cogenerated Heat for Phase I and Phase II Customers, Roy A. Cunniff, Physical Science Laboratory, New Mexico State University, October 1985.

Geothermal Feasibility Analysis for County of San Bernardino Jail Center Complex, Roy A. Cunniff and Prasan Chintawongvanich, Physical Science Laboratory, New Mexico State University, October 1985.

Special Report, Disposal of Geothermal Water Containing Elevated Fluoride Levels, San Bernardino, California, Roy A. Cunniff, Physical Science Laboratory, New Mexico State University, March 1984.

Special Report, Environmental Assessment of Geothermal Water Disposal at Radium Springs, New Mexico, Roy A. Cunniff, Hunt Energy Corporation, May 1984.

Special Report, Potential Treatment Methods for Fluoride-Laden Ground Water Campus Crusade for Christ, Arrowhead Hot Springs, California, Roy A. Cunniff, July 1985.

Computer Simulated Turbine Generators (PWRPC), Prasan Chintawongvanich, Roy A. Cunniff, Physical Science Laboratory, New Mexico State University, May 1985.

Geothermal Feasibility Analysis for County of San Bernardino Government Complex, San Bernardino, California, Roy A. Cunniff, Prasan Chintawongvanich, Physical Science Laboratory, New Mexico State University, April 1985.

NMSU Geothermal Exploratory Well DT-3, Interim Completion Report, Roy A. Cunniff, Prasan Chintawongvanich, Physical Science Laboratory, New Mexico State University, January 1985.

NMSU Geothermal Demonstration Project, Roy A. Cunniff, Prasan Chintawongvanich, Geothermal Resources Council Transactions, Vol. 7, 1984.

ROGER L. BOWERS
701 Sanford Court
Arlington, Texas 76012

PROFESSIONAL EXPERIENCE

1975 to present: HUNT ENERGY CORPORATION, Dallas, Texas

June 1983 to present: Manager of Geothermal Department. Responsible for all geothermal exploration and development programs. Duties include management of geotechnical exploration surveys, technical and economic evaluation of prospects, department budget and staff. Coordinate all geothermal programs with other company departments such as land, legal, tax, and accounting. Directly involved in all contract and agreement negotiations, marketing, leasing, and government liaison for geothermal. Also supervise and/or advise all non-geothermal company projects involving alternate energy sources and hydrology.

September 1979 to June 1983: Senior Geothermal Geologist. Responsible for all geothermal exploration operations and prospect evaluation. Duties included direct supervision of department staff, planning and managing of all geological, geophysical, and geochemical exploration surveys, and survey data evaluation and interpretation. Developed company geothermal deep drilling programs, government-required plans of operation for environmental protection, and permitted and coordinated all geothermal wildcat drilling. Also initiated and supervised transition of geothermal records and data to computer systems.

October 1975 to September 1979: Staff Geothermal Geologist. Responsible for field exploration surveys, data acquisition, and interpretation. Duties included planning of exploration surveys, permitting, supervision of contracted field crews, and data reduction and interpretation. Involved in all aspects of geothermal surveys including geologic mapping, heat flow (temperature gradient drilling), electrical resistivity, magnetotellurics, gravity, magnetics, seismic, soil mercury and geochemistry.

1973 to 1975: HUNT OIL COMPANY, Dallas, Texas

March 1975 to October 1975: Staff Geologist. Responsible for reconnaissance geological and geophysical evaluation of geothermal prospects in the western United States. Geothermal department was transferred from Hunt Oil Company to Hunt Energy Corporation in October 1975.

January 1973 to September 1974: Assistant Photogeologist. Part-time employment while in graduate school. Duties included geologic interpretation of air photos and compilation of photos into geologic maps for the Overthrust area in western Wyoming. Involved in regional studies for geothermal resources from December 1973 to September 1974.

EDUCATION

1971 to 1975: UNIVERSITY OF TEXAS AT ARLINGTON, Arlington, Texas

1973 to 1975: Graduate School. Received Master of Science Degree in Geology, May 1975.
Emphasis: Sedimentary petrology and diagenesis.
Minor: Physics.
Thesis: Petrography and Petrogenesis of the Alibates Dolomite and Chert (Permian), Northern Panhandle of Texas.
Scholarships, Awards:
American Association Petroleum Geologists: Research Grant.
Dallas Geological Society: Scholarship Award, 1974-75.
Sigma Xi: Research Grant.
Sigma Xi: Outstanding Student Research Award, UT Arlington.

1971 to 1972: Received Bachelor of Science Degree in Geology, December 1972.
Minor: Physics.

1969 to 1971: Active Duty, U.S. Army, Field Artillery.

1963 to 1969: UNIVERSITY OF UTAH, Salt Lake City, Utah.

Major: Geology.
Emphasis: Mineralogy and paleontology.
Minor: Physics.

PROFESSIONAL AFFILIATIONS

American Association of Petroleum Geologists (EMD charter member).
Geothermal Resources Council (President of D/FW Section, 1979-80).
Sigma Xi, The Scientific Research Society of North America.
Society of Mining Engineers.
Oregon Registered Geologist #465.

PUBLICATIONS

Scott, R. W., R. L. Bowers, and others, 1973, Benthic community succession in a Cretaceous carbonate to shale transition: Abstracts with Programs, 1973 Annual Meetings, The Geological Society of America, vol. 5, no. 7, p. 801.

Bowers, R. L., and D. F. Reaser, 1974, Local chert occurrence in Alibates Dolomite, Alibates National Monument and vicinity, northern Panhandle of Texas: Abstracts with Programs, 1974 South-Central Meetings, The Geological Society of America, vol. 5, no. 2, p. 96.

PUBLICATIONS (continued)

Bowers, R. L., and D. F. Reaser, 1975, Replacement chert in the Permian Alibates Dolomite, Panhandle of Texas: Abstracts with Programs, 1975 Annual Meetings, The Geological Society of America, vol 7, no. 7, p. 1005.

Bowers, R. L., 1976, Petrography and petrogenesis of the Alibates dolomite and chert (Permian), northern Panhandle of Texas: Petroleum Abstracts, October 2, 1976, vol. 16, no. 40, p. 1470.

Sanford, R. M., R. L. Bowers and J. Combs, 1979, Rio Grande rift geothermal exploration case history: Elephant Butte prospect, south central New Mexico: Geothermal Resources Council Transactions, 1979 Annual Meeting, vol. 3, p. 609-612.

Sibbett, B. S., J. Zeisloft and R. L. Bowers, 1982, Geology of MacFarlane's Spring thermal area, Nevada, Geothermal Resources Council Transactions, 1982 Annual Meeting, vol. 6, p. 47-50.

Swanberg, C. A., and R. L. Bowers, 1982, Downward continuation of temperature gradients at MacFarlane's Hot Spring, northern Nevada, Geothermal Resources Council Transactions, 1982 Annual Meeting, vol 6, p. 177-180. (Best Paper Award, 1982 Annual Meeting, Geophysics section)

ESL 9 Nov. '85

New Mexico Energy Research and Development Institute

DIRECTOR
Larry Icerman

November 27, 1985

Ms. Peggy Brookshier
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Re: Reprogramming of funds under Grant No. DE-FG07-84ID12546

Dear Ms. Brookshier:

Pursuant to several informal discussions with Duncan Foley, please find enclosed two (2) copies of a proposed plan for reprogramming some of the funds under the above grant. This redirection is necessary because successfully executing the current work plan was predicated on the existence of a healthy geothermal exploration industry in New Mexico and elsewhere. As I am sure you are aware, the geothermal energy industry is in severe economic turmoil which has made the acquisition of matching funds for drilling programs a scarce commodity.

The enclosed revised workplan retains a focus on collecting and analyzing resource information from new test holes; however, an effort to package data from existing boreholes in a format of interest to recently reorganized geothermal energy firms that may wish to acquire a lease position in New Mexico at some time in the future has been added. A small effort is directed toward potential geothermal energy project developers who may ultimately encourage the resource development community to be more active in the future.

As in the past, the State of New Mexico, through the New Mexico Energy Research and Development Institute, the New Mexico Energy and Minerals Department, and New Mexico State University, has pledged substantial ($93,000) financial resources as a contribution to the proposed work plan. These funds represent an additional $20,000 beyond the amount pledged previously.

I hope that you will give favorable consideration to the proposed reprogramming plan. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:al

cc: Duncan Foley, URRI
File DE-FG07-84ID12546

DOE F 4200.33
(Rev. 11-82)

U.S. Department of Energy

Procurement Request-Authorization

Formerly PR-799A
(Previous editions are obsolete)

1. To Awarding Office: Contracts Management Division
2. From Initiating Office: Advanced Technology Division
3. PR Number: 07-85-D12546-501
4. Change/Correction to a PR in Process? ☐ Yes ☒ No
5. If Item 4 is yes, enter PR correction Letter
6. ☐ Procurement ☒ Assistance
7. Consistent with Principal Purpose of Program? ☒ Yes ☐ No
8. Action Description/Title (180 char. max.): Geothermal Research Grant

If award is competitive, has list of sources been attached? ☐ Yes ☐ No — If Non-Competitive, Complete Items 9-11.

9. Name: New Mexico Energy Research & Dev Inst
10. Division:
11. Address: 1220 St. Francis Dr. Rm 358, Pinon Bldg, Santa Fe, NM 87501
12. For Procurement Actions Only: Product or Service Code:
13. For Assistance Actions Only: CFDA Number: 81.087
14. Cooperative Agreement ☐
15. Grant ☒
16. Controlled Deliverable For All Actions:
17. Kind of Award Action (Recommended): 1P
18. Master Bin:
19. Desired Award Date: Mo Day Year
20. Unsolicited Proposal Number:
21. Project Number: DE-FG07-84ID12546
22. Government Property: N — F-Furnished, P-Purchased, N-Not involved

FINANCIAL DATA

23. Government Share: 20 000
24. Awardee Share: 5 000
25. Total: 25 000

FY FUNDS COMMITTED

26. Approp. Symbol	27. B&R Number	28. Dollar Amt.	29. Allotment	30. Object Class	31. AFP	32. CFA
89X0227.91	AM1510000	20 000	ID-54-01	25 410		

33. From Continuation Sheet
Total Funds this PR: 20 000

35. Project Period from: Sept. 30 1985 thru 9/30/86
36. Budget Period from: 9/30/85 thru 9/30/86

PROJECT MANAGER/INITIATOR

37. Name: Peggy A.M. Brockshier
38. Signature: Peggy A.M. Brockshier
39. Date: 8/23/85
40. Office Code:
41. FTS Telephone Number: 583-1403

PROGRAM REVIEWING OFFICIAL

42. Name: Charles E.G. Imere
43. Signature: Earl Fenwick for
44. Date: 8/23/85

PROGRAM OFFICE BUDGET OFFICIAL

45. Name: Dennis R. Bell
46. Signature: Dennis Bell

CERTIFYING OFFICIAL. I hereby certify that the funds cited in item 34 are available

47. Name: Frank J. Smith
48. Signature: F. Smith
49. Date: 8/23

CONTRACTING OFFICE

U.S. DEPARTMENT OF ENERGY

DOE F 4220.2 (6-80) (Formerly PR-415)

SMALL BUSINESS/LABOR SURPLUS SET-ASIDE REVIEW

I.D. NO.

ITEM TITLE/DESCRIPTION
New Mexico Energy Research & Dev. Inst.
FY 85 Grant - Geothermal

SMALL BUSINESS SIZE STANDARD RECOMMENDED BY S.B. SPECIALIST
EMPLOYEES NUMBER ______
DOLLAR $ ______
SIC CODE: ______

PROGRAM OFFICE: Advanced Technology

PROCURING ACTIVITY: Contracts

SB/LS PARTICIPATION WAS CONSIDERED IN THE PREPARATION OF THIS PROCUREMENT ITEM AND FOLLOWING IS RECOMMENDED:

- ☐ Small Business Set-Aside ______ % $ ______
- ☐ Labor Surplus Set-Aside ______ % $ ______
- ☐ SBA Section 8(a) Procurement
- ☒ Set-Aside Action Not Recommended

NAME AND LOCATION OF PROPOSED SOURCE: (If Sole Source)

- ☐ Small Business
- ☐ Minority
- ☐ Labor Surplus Firm
- ☐ Other

SET-ASIDE NOT FEASIBLE BECAUSE:

- ☐ No Reasonable Expectation of Receiving Sufficient Offers from SB/LS Firms to Assure Award*
- ☐ Program Objectives Dictate Broadest Possible Solicitation to Obtain "Best Available" Expertise*
- ☐ Solicitation if for "Best Idea/Approach" R&D Effort
- ☐ Continuing and Directly Related R&D Effort. Competitive Procurement Not Feasible for Economic and/or Technical Reasons
- ☐ Procurement is for Completion or Within-Scope Expansion of Current Contract
- ☐ This is for Extension of Current Services to Allow Preparation/Award of Competitive Follow on Procurement
- ☐ Sole Source as Determined Under Current DOE Policy Directives
- ☐ Funding of Unsolicited Proposal Under Current DOE Policy Directives
- ☒ Other*

*Explanation Required

EXPLANATION/ADDITIONAL COMMENT:
State Teams Geothermal activity to promote technology utilization within participating states. A Justification for Restricted Eligibility has been approved

SMALL BUSINESS SPECIALIST CONSULTED *(Check One)* ☒ Yes ☐ No

[signature] — P.R. REQUESTOR

6-1403 — TELEPHONE

8/23/85 — DATE

SMALL BUSINESS SPECIALIST'S ENDORSEMENT

- ☐ Accepts ☐ Requests Reevaluation
- ☐ Request Solicitation of SB/LS Sources Attached
- ☐ Request Special SB/LS/MB Incentive Provisions (Attached)
- ☐ Other Comments/Attached

SMALL BUSINESS SPECIALIST ______ DATE ______

REEVALUATION OF RECOMMENDATIONS/FINDINGS

- ☐ Reaffirmed
- ☐ Set-Aside Feasible

AUTHORIZING PROGRAM OFFICIAL ______ DATE ______

REVIEWED BY SBA

- ☐ Request Solicitation of SB Sources Attached

SBA Form 70 Attached ☐ Yes ☐ No

SBA REPRESENTATIVE ______ DATE ______

PROCUREMENT OFFICER'S ACTION

- ☐ SB/LB Set-Aside ☐ Set-Aside Not Initiated
- ☐ Other Recommendations/Request Noted and Appropriate Action Taken

PROCUREMENT OFFICER ______ DATE ______

CONTRACT NO.(S) SB/MB/OTHER

ORIGINAL-CONTRACT FILE (FULLY EXECUTED)

New Mexico Energy Research and Development Institute

DIRECTOR
Larry Icerman

August 6, 1985

Ms. Peggy A.M. Brookshier
U.s. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Dear Ms. Brookshier:

In response to your letter of August 2, 1985, please find enclosed a signed copy of the "Assurances" form and documentation of the audited indirect cost rates of the Physical Science Laboratory at New Mexico State University. The administrative costs incurred by the New Mexico Energy Research and Development Institute (NMERDI) have not been included in the budget request to the Department of Energy and represent direct costs only; thus, no documentation of the NMERDI indirect cost rates is enclosed.

I trust the enclosed information will meet your needs. If you have any questions or need additional information, please do not hesitate to contact me.

Sincerely yours,

Larry Icerman

LARRY ICERMAN
Director

LI:cc

Enclosure

Room 358, Piñon Building, 1220 S. St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

ASSURANCES

Applicant hereby assures that it will comply with the regulations, policies, guidelines and requirements, including the applicable OMB Circulars as they relate to the application, acceptance and use of Federal funds for this federally-assisted project. Also the Applicant assures and certifies that:

It possesses legal authority to apply for the grant; that a resolution, motion or similar action has been duly adopted or passed as an official act of the applicant's governing body, authorizing the filing of the application including all understandings and assurances contained herein, and directing and authorizing the person identified as the official representative of the applicant to act in connection with the application and to provide such additional information as may be required.

It will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352) and in accordance with Title VI of that Act, no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the applicant receives Federal financial assistance and will immediately take any measures necessary to effectuate this agreement.

It will comply with Title VI of the Civil Rights Act of 1964 (42 USC 2000d) prohibiting employment discrimination where (1) the primary purpose of a grant is to provide employment or (2) discriminatory employment practices will result in unequal treatment of persons who are or should be benefiting from the grant-aided activity.

It will comply with requirements of the provisions of the uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (P.L. 91-646) which provides for fair and equitable treatment of persons displaced as a result of Federal and federally assisted programs.

It will comply with the provisions of the Hatch Act which limit the political activity of employees.

It will comply with the minimum wage and maximum hours provisions of the Federal Fair Labor Standards Act, as they apply to hospital and educational institution employees of State and local governings.

It will establish safeguards to prohibit emmployees from using their positions for a purpose that is or gives the appearance of being motivated by a desire for private gain for themselves or others, particularly those with whom they have family, business, or other ties.

It will give the sponsoring agency or the Comptroller General through any authorized representative the access to and the right to examine all records, books, papers, or documents related to the grant.

It will comply with all requirements imposed by the Federal sponsoring agency concerning special requirements of law, program requirements, and other administrative requirements.

It will insure that the facilities under its ownership, lease or supervision which shall be utilized in the accomplishment of the project are not listed on the Environmental Protection Agency's (EPA) list of Violating Facilities and that it will notify the Federal grantor agency of the receipt of any communication from the Director of the EPA Office of Federal Activities indicating that a facility to be used in the project is under consideration for listing by the EPA.

It will comply with the flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973, Public Law 93-234, 87 Stat. 975, approved December 31, 1976. Section 102(a) requires, on and after March 2, 1975, the purchase of flood insurance in communities where such insurance is available as a condition for the receipt of any Federal financial assistance for construction or acquisition purposes for use in any area that has been identified by the Secretary of the Department of Housing and Urban Development as an area having special flood hazards.

The phrase "Federal financial assistance" includes any form of loan, grant, guaranty, insurance payment, rebate, subsidy, disaster assistance loan or grant, or any other form of direct or indirect Federal assistance.

It will assist the Federal grantor agency in its compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (16 U.S.C. 469a-1 et seq.) by (a) consulting with the State Historic Preservation Officer on the conduct of investigations, as necessary, to identify properties listed in or eligible for inclusion in the National Register of Historic Places that are subject to adverse effects (see 36 CFR Part 800.8) by the activity, and notifying the Federal grantor agency of the existence of any such properties, and by (b) complying with all requirements established by the Federal grantor agency to avoid or mitigate adverse effects upon such properties.

The Applicant certifies that it will comply with the above assurances if the assistance is approved.

Grant Applicant: New Mexico Energy Research and Development Institute

Project Title: Geothermal Exploration Well at New Mexico State University

Certifying Representative: Larry Icerman
Signature

Larry Icerman, Director
Name and Title

August 6, 1985
Date

3950H

PHYSICAL SCIENCE LABORATORY

Box 3548, Las Cruces, New Mexico 88003-3548
Area (505) 522-9100 TWX 910-983-0541

August 9, 1985

Larry Icerman, Director
New Mexico Energy Research and
Development Institute
Room 358, Pinon Building
1220 S. St. Francis Drive
Santa Fe, NM 87501

RE: PSL Proposal 85-NM-168

Dear Dr. Icerman:

1. Forwarded in response to your telephonic request to Roy A. Cunniff is a copy of the FY1985 Negotiation Agreement between New Mexico State University and the Office of Naval Research. This agreement was in effect at the time referenced proposal was submitted.

2. Negotiations have been completed for FY1986 rates covering the period 7/1/85 to 6/30/86. However, formal notification has not yet been received. In the interim, we are using rates as negotiated which are itemized as follows:

Type	Rate
Overhead for Sponsored Research, PSL	24.0%
Employee Benefits (PSL only)	
Fringe Benefits	20.5%
Leave Benefits	17.5%
Allocated Direct Labor	21.0%

3. A copy of the formal agreement will be forwarded when available.

Sincerely,

Gustav J. Freyer
Director

Enclosure a/s

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
RESIDENT REPRESENTATIVE
UNIVERSITY OF NEW MEXICO
BANDELIER HALL WEST
ALBUQUERQUE, NM 87131

IN REPLY REFER TO

NEGOTIATION AGREEMENT

INSTITUTION: New Mexico State University
Las Cruces, New Mexico 88003

The indirect cost rates contained herein are for use on grants and contracts with all Federal agencies in accordance with the cost principles mandated by Office of Manpower Budget (OMB) Circular A-21, and are for use on grants and contracts with all Federal activities in accordance with OMB Circular A-88 subject to the conditions contained in Section II.

SECTION I: Rates - Type: Final; Fixed; Predetermined (Pred); Provisional (Prov)

Type	Effective Period From	To	Rate	Base	Applicable to	Location
Overhead						
	7/1/84	6/30/85	21.5%	(a)	Sponsored Research Physical Science Lab.	On-Campus
	7/1/84	6/30/85	11.0%	(a)	Sponsored Research Physical Science Lab.	Off-Campus
	7/1/84	6/30/85	26.0%	(a)	Sponsored Research Agriculture	All
	7/1/84	6/30/85	54.0%	(a)	Sponsored Research	On-Campus
	7/1/84	6/30/85	38.0%	(a)	Sponsored Research	Off-Campus
	7/1/84	6/30/85	54.0%	(a)	Sponsored Instruction	All
	7/1/84	6/30/85	60.0%	(a)	Sponsored Research	Primate Center
	7/1/84	6/30/85	23.0%	(a)	Sponsored Activity International Programs	All
Employee Benefits (PSL only)						
Fringe Benefits	7/1/84	6/30/85	20.0%	(c)	Physical Science Lab.	All
Fringe Benefits	7/1/84	6/30/85	18.0%	(b)	Physical Science Lab.	All
Limited Direct Labor						
	7/1/84	6/30/85	18.0%	(d)	Physical Science Lab.	All

OVERHEAD NEGOTIATION

location Bases

(a) Total Direct Cost excluding subgrant and subcontract expenditures in excess of $25,000 per agreement, capital expenditures, lease or rental of facilities and student aid.

(b) Direct staff salaries and wages (excluding overtime expense, straight or premium) and allocated direct labor.

(c) Direct staff salaries and wages (including overtime expense, straight and premium) allocated direct labor, and employee leave benefits.

(d) Direct staff and student salaries and wages (excluding overtime, straight and premium, and sabbatical leave).

SECTION II - General

1. The recommendations and advice contained in Defense Contract Audit Agency, Phoenix Branch Office Advisory Report No. 7211-4E160770-001, covering actual incurred costs for the Contractor's Fiscal Years 1 July 1982 through 30 June 1983 was considered in the negotiation of the fixed rates set forth herein for the period 1 July 1984 through 30 June 1985.

2. In accepting a fixed overhead rate the University is precluded from making any changes in the agreed upon direct charges or basis of allocation without prior approval of the Contracting Officer executing this Agreement, or his successor.

3. The fixed rates established in this agreement are pre-determined rates based on an estimate of costs which will be incurred during the period for which the rate applies. When the actual costs for such period have been determined, a carry-forward adjustment will be made in the negotiation for a subsequent period to compensate for the difference between the costs resulting from the application of the fixed rates and negotiated actual costs.

4. LIMITATIONS: Use of the rates contained in this Agreement are subject to any statutory limitations, and are applicable to a given contract or grant consistent with the limitation of costs provisions contained therein.

FOR THE UNIVERSITY	FOR THE GOVERNMENT
Robert E. Kirkpatrick /s/	/s/
Robert E. Kirkpatrick Name	G. MAX IRVING Name
Vice President for Business Affairs Title	ADMINISTRATIVE CONTRACTING OFFICER Title
July 27, 1984 Date	July 30, 1984 Date
	(Telephone: 505-277-3851