CONTRACTING AGENCY: UNIVERSITY OF ARIZONA
CONTRACT NUMBER(S): EG-77-S-02-4362, DE-FG07-79ID12019
PRINCIPAL INVESTIGATOR: [illegible]

CONTRACT PERIOD	$ CONTRIBUTION DOE	$ CONTRIBUTION STATE	WORK DESCRIPTION	LOCATION	REMARKS
3/1/77 - 4/15/78	95,301	- 0 -	• [illegible] STUDIES	STATEWIDE	
1/1/78 - 12/31/80	306,739	- 0 -	• EXPLORATION TECHNIQUE	GENERAL	
			• SITE SPECIFIC STUDIES	"	
			• ENERGY RESOURCE MAP	"	
Mar. ? - ?	130,231	- 0 -			
4/1/81 - 5/31/83			• TIME EXTENSION		
5/15/80 - 4/15/81	310,000	- 0 -	• GEOCHEM	AVRA VALLEY	
			• LOCATE, SAMPLE, TEST	ALL AREAS WITH [illegible]	
			• MAPPING WATER TABLE ASSOC.	[illegible]	
			• HEAT FLOW MODELS	STATEWIDE	
			• GRAVITY SURVEY & STRUCTURAL GEOLOGY, WELL TIES,	NORTHERN HASSAYAMPA PLAINS	
			• [illegible]	[illegible]	
			[illegible]	[illegible]	
			[illegible]	[illegible]	
			[illegible]	[illegible]	
			[illegible]	TUCSON AREA	

LOW-TEMPERATURE GEOTHERMAL RESERVOIR

SITE EVALUATION IN ARIZONA

DOE/DGE Contract EG-77-S-02-4362

by

Bureau of Geology and Mineral Technology
Geological Survey Branch
The University of Arizona
845 North Park Avenue
Tucson, Arizona 85719

EXPLORATION AND EVALUATION PROGRAM

During the prior nine months of exploration and evaluation, five areas have been designated for more detailed investigation. These areas are: (1) Springerville-St. Johns, (2) Clifton-Morenci-Safford, (3) San Bernardino valley, (4) Phoenix, and (5) Tucson. In addition, an area near the prison complex in Florence will probably be investigated for the purpose of determining the possibility of supplying geothermal energy to the facility.

The geological program, as well as determining new regions of investigation, includes detailed and reconnaissance mapping using as base maps the available U.S.G.S. topographic maps. Attention will be given to determining the structure, stratigraphy, alteration and lithologic relationships of important rock units. The subsurface structure and stratigraphy, as determined from drill logs and cuttings on file with the Bureau of Geology and Mineral Technology, Geological Survey Branch in Tucson, will be studied, where available, in order to construct a three dimensional geologic picture which is most necessary in order to define and model the geothermal energy resource under investigation.

The geochemical program consists primarily of collecting for chemical analyses 500 water samples from wells and springs. This sampling program is designed to supplement previous work done by the U.S. Geological Survey and Dr. Chandler Swanberg of New Mexico State University. Sampling will be conducted in the main areas of interest and also on a regional reconnaissance basis. Each sample will be analyzed for Na, Ca, K, SiO_2 and total dissolved solids. Eh and pH measurements will be conducted in the field at the time of sample collection. The elements and compounds being

analyzed are used as geochemical geothermometers to determine possible/probable subsurface reservoir temperatures. The total cost of analysis per sample will be approximately $21.00.

Additional money has been budgeted in the geochemical program for soil and rock analyses, rock age dating, and the manufacture of thin-secions for petrographic analysis.

The geophysical program is currently in a state of flux. Dr. Marc Sbar, Seismologist, University of Arizona, has planned a passive seismic study in three areas, Springerville-St. Johns, Clifton-Morenci-Safford and San Bernardino valley.

The purpose of this passive seismic study is as follows:

1. map active faults which may serve as conduits for hot water or steam
2. determine principal stress orientations in the area of the seismicity
3. determine orientation and sense of strike and/or dip slip on the faults
4. define the extent and depth of a magma chamber, should one exist within the limits of detection of the survey
5. detect regions of fluid saturation
6. detect active fluid movement within the seismic study area

As well as contributing valuable exploration information to the program, the passive seismic survey will also contribute to the environmental assessment of the areas under exploration. The monetary value of the passive seismic program and the information obtained from it will greatly exceed the actual cost of the program. Dr. Sbar's program is to be funded at $14,000.00

At the present time negotiations to combine geophysical programs are underway among Los Alamos Scientific Laboratory, outside advisors to the Arizona program, New Mexico State University, and the Geological Survey

Branch, University of Arizona, all of whom have planned to undertake geophysical work in Arizona this year. The combined programs would cover more and larger areas, thereby maximizing effort and minimizing cost.

Additional geophysical programs, including well temperature logging and heat flow measurements are being planned and will be conducted by the combined groups. Monies have been budgeted to assist these programs.

GEOTHERMAL ENERGY RESOURCE MAP

The Geological Survey Branch will also compile and construct a geothermal energy resource map of Arizona at a scale of 1:500,000. The approximate size of this map with explanation is 48 by 70 inches and will be printed in color front and back. The map will be published by Paul Grim of the National Geophysical & Solar-Terrestrial Data Center, National Oceanic and Atmospheric Administration, Environmental Data Service, U.S. Department of Commerce, with a tentative release date of January or February, 1979.

In conjunction with the above-mentioned map a lineament map is to be constructed at a scale of 1:500,000 primarily from Skylab S-190A photographs which, with a variety of solar azmuths, cover over 99 percent of Arizona. Skylab photographs have no scan lines which often interfere with the interpretation of lineaments from Landsat images. The 1:500,000 lineament map will be published as a part of the geothermal energy resource map of Arizona. The sum of $7,000,00 has been budgeted for this study.

PROPOSED BUDGET

January 16, 1978 - January 15, 1979

SALARIES AND WAGES

W.R. Hahman, Sr., Geologist Principal Investigator	$18,521.00	May 1, 1978 - January 15, 1979
Claudia Stone, Geologist	18,585.00	January 16, 1978 - January 15, 1979
James C. Witcher, Geologist	14,863.00	February 1, 1978 - January 15, 1979
Tracee Calhoun, Secretary	1,731.00	August 1, 1978 - January 15, 1979
Daniel B. Dwyer, Drafter	5,600.00	January 9, 1978 - January 15, 1979
	$59,300.00	
Fringe Benefits @ 16.5%	9,784.50	
	$69,085.00	

GEOLOGICAL PROGRAM		$20,400.00
field travel		
400 mandays at $30./day	$12,000.00	
40,000 field miles at 0.21/mile	8,400.00	
	$20,400.00	
GEOCHEMICAL PROGRAM		$14,350.00
water and rock analyses age dating and thin sections		
GEOPHYSICAL PROGRAM		$31,268.00
passive seismic and others		
SKYLAB PROGRAM		$ 7,000.00
lineament map		
COMPUTER COSTS		$ 2,000.00
programming and run time		
OFFICE OPERATIONS COSTS		$ 5,000.00
expendable supplies and drafting equipment		

LIBRARY ADQUISITIONS		$ 2,000.00
TRAVEL AND PER DIEM		$ 5,000.00
scientific meetings and conferences		
PUBLICATION COSTS		$20,000.00
geothermal energy map of Arizona		
TOTAL DIRECT COSTS (TDS)		$176,103.00
INDIRECT COSTS (37% of TDC)		$ 65,158.00
TOTAL		$241,261.00
CAPITAL ITEMS		$ 8,739.00
light-weight temperature logging unit	$4,000.00	
binocular and petrographic microscopes with photographic mount	4,739.00	
	$8,739.00	
GRAND TOTAL		$250,000.00

File M2.1

Contract No. EG-77-S-02-4362

CONTRACT BETWEEN
ARIZONA BOARD OF REGENTS
AND
THE U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

THIS AGREEMENT is effective the 1st day of May , 1977, between the UNITED STATES OF AMERICA (hereinafter referred to as the "Government"), acting through the ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (hereinafter referred to as "ERDA"), and ARIZONA BOARD OF REGENTS a corporation duly organized and existing under the laws of the State of Arizona with its principal office in Phoenix, Arizona (hereinafter referred to as the "Contractor"),

WITNESSETH THAT:

WHEREAS, ERDA wishes to have the Contractor perform certain research work, as hereinafter provided; and

WHEREAS, this agreement is authorized by the Energy Reorganization Act of 1974 and other applicable law;

NOW, THEREFORE, the parties hereto agree as follows:

ARTICLE I - THE RESEARCH TO BE PERFORMED

(a) The Contractor shall, to the best of its ability, furnish personnel, facilities, equipment, materials, supplies, and services, except such as are furnished by the Government, necessary for the performance of the research provided for in Appendix A and shall perform the research and report thereon pursuant to the provisions of this contract. It is understood that Appendix A, a guide to the performance of this contract, may be deviated from by the Contractor subject to the specific requirements of this contract.

(b) This work shall be conducted under the direction of Dr. Richard Hahman or such other member of the Contractor's staff as may be mutually satisfactory to the parties.

ARTICLE II - THE PERIOD OF PERFORMANCE

The period of performance under this contract shall commence on May 1, 1977 and expire on April 30 , 1978. Performance may be extended for additional periods by the mutual written agreement of the parties.

ARTICLE III - CONSIDERATION

(a) In full consideration of the Contractor's performance hereunder, ERDA shall furnish the equipment, supplies, materials, and services, if any, listed in Article A-II(b) and pay the Contractor the sum of $95,301.00 hereinafter called the "Support Ceiling" which sum shall be subject to adjustment as hereinafter provided.

(b) Payments to the Contractor shall equal the "Cumulative Support Cost" of the performance of this contract, as the term "Cumulative Support Cost" is defined in Article B-XXVIII; Provided, however, And notwithstanding any other provision of this contract, that the Government's monetary liability under this contract shall not exceed the Support Ceiling specified in (a) above. ERDA shall not pay more than the Support Ceiling or an amount equal to the Cumulative Support Cost, whichever is less. The Contractor shall be obligated to perform under this contract throughout the agreed-upon period of performance, and to bear all costs which ERDA has not agreed to pay; Provided, however, That the Contractor shall have the right to cease to perform the research provided for in this contract, upon written notice to ERDA to that effect, at any time when or after the Cumulative Support Cost equals or exceeds the Support Ceiling.

(c) The Support Ceiling specified in (a) above may be increased unilaterally by ERDA by written notice to the Contractor and may be increased or decreased by written agreement of the parties (whether or not by formal modification to this contract). In the event the stated period of contract performance is extended, the Support Ceiling will be revised to reflect any increased ERDA support for the extended period or periods.

(d) Upon termination, or expiration of the total period of performance, the Contractor shall promptly refund to ERDA (or make such disposition as ERDA may in writing direct) any sums paid by ERDA to the Contractor under this contract, through direct payment or under letter of credit, in excess of the Cumulative Support Cost incurred in performance under the contract.

ARTICLE IV - GOVERNMENT PROPERTY

The following items of property procured or fabricated by the Contractor are hereby listed as "Government property":

None

ARTICLE V - APPENDICES

Appendix A, Appendix B - General Provisions, Appendix C - Statement of Costs, and Appendix D - Intellectual Property Provisions, are hereby attached to and made a part of this contract.

APPENDIX A

For the Contract Period May 1, 1977 through April 30, 1978.

Article A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

(a) The scope of work under this contract is unclassified and shall consist of: (1) accomplishing a preliminary synthesis of the data presently available concerning the distribution of the potential low and moderate temperature geothermal resources in the State of Arizona; (2) conducting preliminary field surveys of promising sites identified on the basis of existing information. These preliminary surveys will include the sampling and analysis of surface and ground waters, mapping of rock alteration, and a preliminary survey of the geologic setting and hydrogeology of the area; (3) subcontracting for preliminary environmental assessments of areas being examined as potential phase two reservoir confirmation sites; and (4) providing a coordinator who will be responsible for the integration of related State and Federal geoscience research projects potentially contributing to the low and moderate temperature geothermal resource inventory.

(b) The scope of work shall include such other studies, investigations and services as may be mutually agreed upon.

(c) The Principal Investigator(s) expects to devote the following approximate amount(s) of time to the contract work:

100% of his time for 12 months.

Article A-II WAYS AND MEANS OF PERFORMANCE

(a) Items for which support will be provided as indicated in A-III, below:

(1)	Salaries and Wages	$ 44,000.00
(2)	Equipment to be purchased or fabricated by the Contractor	$ - 0 -
(3)	Travel	
	(i) Domestic	$ 2,900.00
	(ii) Foreign	$ - 0 -
(4)	Other direct costs	
(5)	Indirect costs based on a predetermined rate of 37 percent applicable to total direct costs exclusive of items of equipment and other capital expenditures, costs of that portion of a single subcontract in excess of $50,000, and student tuition/fees and stipends.	

File M.2.1 Widmayer

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
M002	7/11/79	none	

RECEIVED
JUL 31 1979
GEOTHERMAL ENERGY BRANCH

5. ISSUED BY CODE
U. S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

6. ADMINISTERED BY (If other than block 5) CODE

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) CODE FACILITY CODE

Board of Regents
University of Arizona
Babcock Building #3313
Tucson, Arizona 85721
Attn: James T. Wheeley, Director
Sponsored Projects Service

8.
☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)
☒ MODIFICATION OF CONTRACT/ORDER NO. DE-FC07-79ID12009
DATED 2/26/79 (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made in the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of Public Law 95-91, and other applicable laws.
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

1. The period of performance set forth under Article V, Term of Agreement, is hereby extended from January 15, 1980, through May 31, 1980.

2. The participant is authorized to subcontract with New Mexico State University (NMSU) for Schlumberger, and telluric current electrical exploration in the White Mountains and Fort Apache Indian Reservation of Arizona in accordance with NMSU Proposal #79-10-468, incorporated herein by reference. Total cost of the subcontract is not to exceed $33,228 and participant is to use funds from the $54,000.00 originally designated in the Cooperative Agreement for well drilling.

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13. ☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 2 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR ARIZONA BOARD OF REGENTS
BY _____ (Signature of person authorized to sign)

15. NAME AND TITLE OF SIGNER (Type or print)
James T. Wheeler, Director
Sponsored Projects Service

16. DATE SIGNED 7/23/79

17. UNITED STATES OF AMERICA
BY _____ (Signature of Contracting Officer)

18. NAME OF CONTRACTING OFFICER (Type or print)
J. P. Anderson, Chief
Contract Administration Br. CMD

19. DATE SIGNED JUL 27 1979

30-101-01

DOE FORM-182
(Rev. 10-77)

U. S. DEPARTMENT OF ENERGY

COOPERATIVE AGREEMENT

PURSUANT TO AUTHORITY OF PL 93-410, PL 93-438, PL 93-473, PL 93-577, and PL 95-91

1a. Agreement No.
DE-FC07-79ID12009

1b. Modification No.

2. Agreement Period
From: Jan. 16, 1979 To: Jan. 15, 1980

3. Participant Name and Address
University of Arizona
2045 N. Forbes, Suite 106
Tucson, Arizona 85705

4. Participant Type
☒ Educational ☒ Nonprofit
☐ State or Local Government ☐ Profit

5. Project Title
Low-to-Moderate Temperature Geothermal Reservoir Site Evaluation in Arizona

6. Project Will Be Conducted Per
See Article II & VI

7. Technical Reports Are Required
See Article VII

8. Principal Investigator(s) or Program Director(s) Name and Address
W. Richard Hahman, Sr.
Principal Investigator
Bureau of Geology & Mineral Technology
2045 N. Forbes, Suite 106
Tucson, Arizona 85705

9. DOE Program Officer (Name and Address)
Leland L. Mink
Idaho Operations Office, DOE
550 Second Street, Idaho Falls, ID 83401
Telephone No. (208) 526-0638

10. Accounting and Appropriation Data

11. Method of Payment
☐ % At Award. % When Requested % Upon Receipt of Final Report
☐ Letter of Credit ☐ Reimbursement
☐ Other (specify) See Article

12. Submit Vouchers, if any, to Agreements Officer Unless Otherwise Specified in this Block
Director, Contracts Management Division, 550 Second Street Idaho Falls, Idaho 83401

13. Funding Sources

Source	Amount
DOE	$ 312,515.00
Participant	$ -0-
Total Funding	$ 312,515.00

14. Remarks:

15. Amount Obligated By This Action $ 226,739.00

16. DOE Issuing Office (Name and Address)
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

17. DOE Cooperative Agreements Officer

(Signature) (Date)

Name (typed) R. E. Simonds

Title Director, Contracts Mgmt. Division

Telephone No (208) 526-1347

18. Participant Acceptance

By
Signature of Authorized Official

Name (typed)

Title

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

The geothermal program in Arizona is one emphasizing the exploration, evaluation and development of low-to-moderate temperature geothermal resources. The FY-79 program will emphasize on area and site specific studies rather than regional reconnaissance geologic investigations. Specific objectives and task areas follow:

(1) Development of a successful exploration technique for the location, evaluation and development of low-to-moderate temperature geothermal resources.

(2) Conduct site specific investigations in areas defined through earlier reconnaissance surveys where a geothermal potential exists and near-term commercialization is evident. This work should include appropriate geologic, geochemical and geophysical investigations to better define the resource potential.

(3) Compile and publish an energy resource map of Arizona through cooperation with the USGS and NOAA. Participate in the update of the Arizona section of the USGS Circular 726 update.

The Participant is also responsible for cost-sharing to the extent provided for in Article III, "Financial Support of the Project."

ARTICLE III - FINANCIAL SUPPORT OF THE PROJECT

A. The total estimated cost of performing the work under this Agreement is Three Hundred Twelve Thousand Five Hundred Fifteen Dollars ($312,515.00). For performance of work under this Agreement, DOE agrees to pay 100% of total allowable costs. The Participant shall be reimbursed by DOE for the costs of the project determined to be allowable in accordance with Article A-I of the General Provisions entitled "Allowable Costs."

C. The amount of funds presently obligated under this Agreement by DOE is Two Hundred Twenty-Six Thousand Seven Hundred Thirty-Nine Dollars ($226,739.00). The balance of Eighty-Five Thousand Seven Hundred Seventy-Six Dollars ($85,776.00) shall be funded if progress on the project warrants it, when and if funds are available.

STANDARD FORM 30 (REV. 10-83)
GENERAL SERVICES ADMINISTRATION
FAR (48 CFR) 53.243

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 2

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
A003	1/16/80	07-80ID12009.501	

5. ISSUED BY	CODE	6. ADMINISTERED BY (If other than item 5)	CODE
U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401			

RECEIVED
APR 9 1980
GEOTHERMAL ENERGY

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) — CODE — FACILITY CODE

Arizona Board of Regents
University of Arizona
2045 N. Forbes, Suite 106
Tucson, Arizona 85705
Attn: James T. Wheeler, Director
Sponsored Project Service

☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)

☒ MODIFICATION OF CONTRACT/ORDER NO. DE-FC07-79ID12009
DATED 6-26-79 (See block 11)

8. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

9. ACCOUNTING AND APPROPRIATION DATA (If required)

10. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of Public Law 95-91, and other applicable Laws.
It modifies the above numbered contract as set forth in block 12.

11. DESCRIPTION OF AMENDMENT/MODIFICATION

1. Add the following paragraph (5) to Article II, Description of Responsibilities:

(5) The Participant shall continue the Low-to-Moderate Temperature Geothermal Site Evaluation in the State of Arizona in accordance with Attachment I to this Modification.

2. The total estimated cost set forth under Paragraph A. of Article III, Financial Support of the Project, is increased by $300,000 from $356,970 to $656,970.

3. The amount of funds obligated under Paragraph C. of Article III, Financial Support of the Project, is increased by $300,000 from $356,970 to $656,970. The total amount obligated includes $226,739 obligated by the original contract, $130,231 obligated by Modification No. A001, and $300,000 obligated by this Modification No. A003.

4. The period of performance set forth under Article V, Term of Agreement, as previously extended by Modification No. M002 to May 15, 1980, is hereby further extended to January 15, 1981. The period of performance for work under this

--continued

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT
☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE

12. NAME OF CONTRACTOR/OFFEROR		17. UNITED STATES OF AMERICA	
ARIZONA BOARD OF REGENTS Maynard E. Carr (Signature of person authorized to sign)		BY (Signature of Contracting Officer)	
13. NAME AND TITLE OF SIGNER (Type or print) Maynard E. Carr, Treasurer and Chief Officer	14. DATE SIGNED 4/3/80	18. NAME OF CONTRACTING OFFICER (Type or print) Neil W. Fraser, Director	19. DATE SIGNED

Modification A003
Cooperative Agreement No.
DE-FC07-79ID12009

STATEMENT OF WORK

During the period from January 16, 1980 through January 15, 1981, the Participant shall perform the following tasks:

Task 1 - Avra Valley

- Compile existing geoscience information for the area including warm well and spring locations, depth temperature and geochemistry. Collect and analyze up to 20 water samples for warm wells greater than 30°C.; log all available wells for bottom hole temperatures, compute thermal gradients, and where core is available, obtain thermal conductivity and heat-flow calculations. Develop a report of the interpretation of data and develop maps depicting geoscience information for the area.

Task 2 - Arizona Hot Springs

- Location, geochemical sampling and water temperatures will be obtained for all Arizona hot springs and the results will be published. All information will be sent to the USGS Geotherm files for incorporation.

Task 3 - Clifton and Gillard Hot Springs

- Geologic structural mapping will be completed in the Clifton area. All available wells and springs will be tested for bottom hole temperatures and thermal gradients, up to 30 water samples will be collected and analyzed. Age dating of ash-flow tuffs and rhyolite intrusives will be completed. A report of the findings from previous work plus this years' effort will be developed.

Task 4 - Heat Flow

- Conduct a state-wide heat flow program for all available wells from which core is available. Obtain bottom hole temperatures, and compute thermal gradients. Compile a heat flow map of Arizona using all available data to date.

Task 5 - Northern Hassayampa Plain

- Conduct a reconnaissance gravity survey over a 140 square mile area. Develop an interpretation of the substructural geology based on the gravity data and other available surface and subsurface structural information. Produce a gravity map of the surveyed area. Conduct a geologic mapping survey of the Belmont Mountains at a 1:24,000 scale. Complete a mercury survey of the reconnaissance area; develop a map of the survey results and interpretations. Collect and analyze about 30

Task 5 - Northern Hassayampa Plain (Cont'd)

water samples from warm wells; obtain bottomhole temperatures and calculate thermal gradients. Develop a report on the geothermal potential of the Hassayampa Plain based on above data, and other available geoscience information.

Task 6 - Reconnaissance

- Collect and analyze water samples from hot wells in areas not previously studied under this contract. Obtain location, well depth, bottom hole temperatures and calculate thermal gradients for all available wells. Compile all available lithologic, structural, geochemical, and geophysical data for each area of significant geothermal potential based on thermal gradient and other information. Supply USGS geothermal file with all new information.

Task 7 - Papago and Yuma

- Collect, analyze, and interpret all geologic, geochemical, and geophysical data available in the Yuma and Pagago Indian Reservation areas. Log all available water wells for location, well depth, bottom hole temperatures, and convert to heat flow holes where possible. Collect and analyze approximately 60 water samples from selected warm wells. Prepare a report of the geothermal potential of the area based on the geoscience information collected.

Task 8 - San Pedro Valley

- Conduct same program as outlined in task 7 with the exception that only 15 water samples will be collected, and maps will be generated based on available geoscience information.

Task 9 - Safford - San Simon Area

- Conduct same program as outlined in Task 7 with the exception that only 30 water sampled will be collected. In addition, a detailed structural map of the basin will be completed, and all available gravity data will be collected. Comparison of structural information and gravity data will be performed, and the basin structure will be modeled using the gravity and surface structural information. A report will be prepared about the findings in the basin.

Task 10 - Tucson Area

- Conduct same programs as outlined in Tasks 7 and 9.

Task 11 - Preliminary Resource Assessment Map

As per the proposal, the Arizona team will assist NOAA in the preparation of a Resource Assessment Map (1:500,000 scale) for public distribution. The map will contain, but not be limited to the following elements: location of wells and springs greater than 30°C. in temperature, geochemistry. Well depth, geothermometry, flow rate, volcanism, KGRA's, physiographic boundaries, and heat flow. All available information to date shall be incorporated. A descriptive pamphlet or ledgend will accompany the map for explanations and further details.