GL00892 Feb, 1980

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

MEMORANDUM

To: Joseph N. Fiore, DOE/NV
Robert A. Gray, DOE/DGE

From: Howard P. Ross

Subject: Review of AMAX Request for Additional DOE Funding for Tuscarora and McCoy Areas; Review of Detailed Data Base

INTRODUCTION

Joseph Fiore (DOE/NV), Joseph Moore and Howard Ross (ESL/UURI) met with Dean Pilkington, Arthur Lange, and Fred Berkman at AMAX Exploration, Inc., Wheat Ridge, Colorado on February 14. The following is a brief evaluation of the technical data as presented by AMAX and some related comments.

TUSCARORA AREA

Temperature, heat flow, gravity, magnetic, magnetotelluric, electrical resistivity, and passive seismic results and interpretations were presented as a series of overlays to geologic and topographic base maps. The presentation was informal, well organized and permitted detailed study as well as the easy integration of major survey results. The bottom line suggested by the data is that Tuscarora is probably one of the three best geothermal prospects in Nevada. I do not know which areas have a better chance of producing electricity except perhaps the Sun discovery in Dixie Valley.

Major northwest and northeast trending structures intersect near Hot Sulphur Springs where a one mile by 0.25 mile hot spring deposit has been formed along a more northerly trending near surface structure. The major structures are expressed to varying degrees in the thermal, gravity, and magnetic data. A microearthquake survey of 11 days recorded a swarm of over 100 events with most epicenters 3-4 miles east of the hot springs.

This gives encouragement for active tectonism of the type which results in considerable (piecewise) fracturing at depth and is often associated with high temperature geothermal systems.

Magnetotelluric and electrical resistivity surveys map a large, deep zone of very low electrical resistivity (2 ohm-m) which includes the hot springs area as its near surface expression. The self-potential data do not contribute substantially to the target concept.

The 10 heat flow unit (hfu) contour, based on 38 thermal gradient holes, includes an equidimensional area of about nine square miles which is centered on the hot springs deposits and major structural intersections. Geothermometry indicates temperatures of 216°- 228°C using a mixing model. The highest directly observed temperature is 123°C at total depth in a 1750 foot temperature gradient hole. Using fair to good thermal gradient control, AMAX projects an area of 9 square miles with temperatures of 260°C at depths of 2000 meters. This may be questioned somewhat but a larger area can be justified for temperatures of 220°C- 240°C at this depth.

The spring waters are of good quality, about 1000 ppm tds, and weakly bicarbonate suggesting a possible carbonate or shale reservoir in Western Facies rocks at depth. The prospect has good size, geology, temperature, structures (permeability), fluids, and good recharge potential. It may be the most promising geothermal venture to which the DOE/DGE is contributing. A drill rig has just moved on site to begin the deep production well test, #56-5, located near the center of the thermal anomaly.

AMAX EXPLORATION PROGRAM

A systematic, questioning reconnaissance exploration led AMAX to discover the Tuscarora and McCoy prospects when lease positions were already established on other major geothermal systems. The exploration since then has been methodical and cost effective. AMAX has done much of the exploration in house and has chosen the more qualified contractors to complete the geophysical work. They have, however, had considerable trouble with road access and drilling problems. When they noted some uncertainty in the temperature distribution at depth they substantially increased the number of drill holes to better define the anomaly. AMAX has shown the

same diligence at McCoy. Not all of the geophysical data has been quantitatively interpreted to date, but this work is in progress. The AMAX exploration effort would be improved by more detailed geologic mapping and numerical modeling. ESL will contribute to this effort as part of the Case Studies program.

CONTRACTUAL AND FUNDING CONSIDERATIONS

As AMAX carried out their exploration programs they departed from the DOE contracts substantially and increased their expenses in drilling, road building, and some geophysical surveys. This was done without formal contract modification with DOE/NV. AMAX feels the DOE participation and rights to data should end when the funds already obligated are used up, unless new funds are made available. They intend to complete the exploration program at Tuscarora and McCoy even if new DOE funds are not available. Arguments advanced on behalf of the government by Fiore and Ross were:

1) AMAX deviated from the DOE contract without notice to the government and without formal contract modifications.
2) Existing contracts call for the DOE to share in the data through the completion of a deep production test well, and a flow test if completed.
3) A deep production well test, i.e. reservoir assessment, has been a key element in the Northern Basin and Range Reservoir Assessment Program since originally described by Dr. J.W. Salisbury, and is so noted in the RFP.
4) The cost of major road construction efforts, to the amount of $270,000 does not contribute to the study of the reservoir itself and these costs should not be a part of the DOE contribution.
5). AMAX should consider a lower government participation rate for the additional gradient holes, geophysical stations, and other work items completed outside the contract.

AMAX realizes that some adjustments are due in view of these arguments, and does intend to cooperate with DOE/NV in forming a contract modification. It is understood that no additional funds are presently identified to meet the AMAX request. However both Tuscarora and McCoy are very promising geothermal systems which have systematically explored in the best intent of the case study program. Supplemental funding would further expand the government's role in the discovery of these promising resources. This would appear to be a more valid use of government funds than subsidizing an effort which requires artifical fracturing and fluid injection and which will be

subeconomic for the forseeable future. Increased funding as requested by AMAX would make their total contract amounts comparable to the contracts with Chevron and Getty at Beowawe, Getty at Colado, Union at Stillwater, and less than the contracts with Aminoil and Southland Royalty for work at Leach Hot Springs and Dixie Valley, respectively. I recommend that a high priority be given to additional funding for the AMAX Tuscarora project, should any funds become available.

Howard P. Ross

Howard P. Ross
Project Manager

February 19, 1980

FEB 4 1980

Robert A. Gray
Division of Geothermal Energy, HQ
RA-233, MS 3344

AMAX GEOTHERMAL RESERVOIR ASSESSMENT CONTRACTS, REQUEST FOR ADDITIONAL FUNDING

Attached for your information and review are copies of recently received AMAX proposals requesting additional government funding support under each of two ongoing geothermal reservoir assessment contracts. Requested amounts are approximately $403K to complete work at the Tuscarora, NV geothermal prospect and $416K to complete work at the McCoy, NV prospect. Such amounts represent increases over original estimates of about 70% in each case.

We have not completed an in-depth technical evaluation of the proposals, but a cursory review indicates that about 98% of the actual and estimated cost overrun is associated with the drilling phases of each contract. Drilling cost overrun elements include: difficult drilling conditions, drilling program changes, and cost escalations. Additional information regarding such cost overrun elements has been requested from the contractor.

The contractor has been advised that there are no funds identifiable in the DOE/DGE FY 80 or 81 budget to support its request. In accordance with the terms of the cost reimbursement type contracts, the contractor is not obliged to provide data from work beyond the government's cost ceiling.

Our current knowledge of work schedules under the subject contracts indicates that the McCoy area work can proceed until early FY 81 without additional funding support. It should be noted that the actual additional funding requirement for the McCoy Phase III work could be significantly less than requested should one of the deep gradient holes be used as the basis for the production/test well. The Tuscarora area work will require additional funding support within the next 6 to 8 weeks, which will be during the early stages of the production/test well drilling.

We have requested that the contractor provide further information with respect to the Tuscarora production/test well cost estimate so that a detailed technical/cost evaluation can be performed. Additionally, with support from the University of Utah Research Institute, a general assessment of the Tuscarora geothermal prospect based upon an analysis of all data acquired through the deep gradient hole phase will be made. The assessment will include a meeting with AMAX personnel during which they will present their interpretations of data acquired to date as it relates to the geothermal potential of the Tuscarora area.

Our recommendations to DGE concerning government funding support beyond the current contract cost ceiling with emphasis on the potential value of the additional data to be acquired through such government support will follow the assessment.

Original Signed by
JAMES B. COTTER

James B. Cotter, Director
Energy Applications Division

EAD:JNF-222

Enclosures:
As stated

cc w/encl:
Dr. H. P. Ross, UURI/ESL,
Salt Lake City, UT

cc w/o encl:
C&P
FIN
OCC

AMAX EXPLORATION, INC.
A SUBSIDIARY OF AMAX INC.

JAN 24 1980

Geothermal	Action	Info
STEARNS		
[illegible]		
FIORE	✓	
ZOLLINGER		
[illegible]		
[illegible]		

GEOTHERMAL BRANCH

ACTION EAD
INFO
R. F.
AMA
AME & C ✓
AMD

January 16, 1980

Contracting Officer
Engineering and Energy Applications Division
Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attn: Joseph D. Fiore

Re: Tuscarora Prospect

Geothermal Reservoir Assessment Cost Study
Northern Basin & Range, DE-AC08-79ET27011

Request for Additional Funding

Dear Joe:

Enclosed is a letter requesting additional funding for the Tuscarora project. Appendix II, which provides invoices of expenditures and details of estimated costs, is not attached to the request. Appendix II will be forwarded to you as soon as the data can be assembled.

Best regards,

Sincerely,

AMAX EXPLORATION, INC.

Harry J. Olson

Harry J. Olson
Managing Geologist
Geothermal Exploration

dm

7100 WEST 44TH AVENUE, WHEAT RIDGE, COLORADO 80033 • TELEPHONE (303) 420-8100 - TELEX 45-556

AMAX EXPLORATION, INC.
A SUBSIDIARY OF AMAX INC.

GEOTHERMAL BRANCH

January 16, 1980

Contracting Officer
Engineering and Energy Applications Division
Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attn: Joseph D. Fiore

Re: Tuscarora Project

Geothermal Reservoir Assessment Case Study
Northern Basin & Range DE-AC08-79ET27011

Request for Additional Funding

Gentlemen:

AMAX Exploration, Inc., a wholly owned subsidiary of AMAX, Inc. requests additional funding to the contract previously awarded AMAX Exploration by the DOE under the Geothermal Reservoir Case Study - Northern Basin and Range Province: Tuscarora, Nevada area (Contract No. DE-AC08-79ET27011). Total additional funding requested from the DOE under this contract is $402,500. This will be expended during FY 1980. The additional funding requested represents 50% of increased costs incurred, or estimated to be incurred, in completing surveys described in the AMAX-DOE Tuscarora contract. Funding of these surveys at 50% will increase the total estimated cost to the DOE of the program from $579,000 to $982,000.

Details of the Tuscarora program, the area to be covered, data to be delivered, and specifics of AMAX Exploration's qualifications, capabilities, representations and certifications are given in RFP No. ET-78-R-08-0003, Tuscarora, Nevada Proposal, AMAX Exploration, Inc., which was submitted to the DOE May 30, 1978.

Details of the increased costs are shown on Table 1 and are further described as follows:

Phase I

As of December 31, 1979 all surveys have been completed. Data has been delivered to the DOE for all surveys except gravity, MT and soil mercury geochem. Results of the gravity survey should be delivered in January, the MT survey in March, and the soil mercury survey by April or May.

The cost of the existing data is $4000.

7100 WEST 44TH AVENUE, WHEAT RIDGE, COLORADO 80033 • TELEPHONE (303) 420-8100 - TELEX 45-556

Cost of the shallow gradient survey is $76,948.50 - almost $51,000 greater than the $26,000 originally estimated. The overage is due to:

1) the increased number of wells required to adequately define the thermal anomaly which is larger than anticipated,

2) difficult rig access to the drill sites. Lack of roads, poor existing roads, and rough topography required contracting another rig with off-road capabilities to complete drilling coverage in the northern portion of the anomaly, and

3) abnormally difficult drilling conditions in the valley fill sediments. Drilling was extremely slow in penetrating a thick boulder horizon. Several holes were lost and had to be moved and redrilled to obtain the thermal data being collected.

The SP survey cost $21,368.00 - an increase of more than $5,000 from the $16,000 originally estimated. The overrun is due to an underestimation of the time required to complete the survey traverses and reduce the data.

Cost of the gravity survey is $22,509.80 - approximately $18,500 more than the $4000 estimated. The original survey cost is based on the use of an AMAX gravimeter by permanent AMAX staff, which according to the contract are not chargeable items, and computer processing of the data by an outside contractor, which is. The gravimeter was damaged and rendered useless in a field accident at the beginning of a DOE funded survey at McCoy and could not be used for the Tuscarora survey. This necessitated the use of a contractor to collect and reduce the gravity data. The increased costs are related to contractor fees and expenses in conducting the survey and reporting the results.

Overruns on the cost of the dipole-dipole and soil mercury geochem surveys subsequently contracted by the DOE are due to the collection of more data than was originally contemplated. DOE funding of these surveys is 100% to a maximum of $20,000 and the DOE is <u>not</u> requested to share in the cost of the overruns for these surveys.

Cost of the MT survey is estimated to be $33,000 - an increase of $17,000 from the $16,000 predicted. Estimated cost increases are due to unanticipated start-up problems related to newly designed state-of-the-art equipment, higher operating costs, and difficulty in collecting data in adverse winter weather conditions.

<u>Phase II</u>

As of December 31, 1979, all surveys have been completed. Data from the aeromagnetic and microearthquake surveys have been delivered to the DOE. Results of the deep gradient survey are still being analyzed and will be delivered as soon as the results are assembled and drafted.

Cost of the aeromagnetic survey is $5,952.11, a savings of greater than $2,000 from the $8,000 estimated. The savings resulted from AMAX combining this survey with several other surveys being flown in 1979 and benefitting in overall lower line-mile costs.

Cost of the MEQ survey is $18,860, approximately $17,000 less than the $36,000 estimated. The savings were obtained by AMAX scheduling the survey to coincide with a seismic test conducted by the U.S. Geological Survey in the Snake River Plain and the happy coincidence of monitoring seismic activity during several microearthquake swarms in the Tuscarora area. The high level of seismic activity in the area coupled with the data obtained from the controlled seismic signals from the test to the north permitted a shorter survey time than is normally required.

The deep gradient survey is estimated to cost approximately $200,500 - an increase of $80,500 from the $120,000 predicted. Three 2000 foot gradient wells were originally forecast. The shape and size of the shallow thermal anomaly required five 1000 foot and one 1750 foot well to adequately test the area of interest. Although the wells are shallower than forecast the increased number of wells and major drilling problems encountered in drilling through a thick boulder horizon caused the overrun.

Phase III

Work on Phase III activities has just begun. A deep production test well (#56-5) has been sited to the west of Hot Creek requiring greater than 4-1/2 miles of road construction, improvement, and surfacing, and substantial rock work in the pad construction. Road and well site costs are estimated to be about $270,000 an increase of $210,000 from the $40,000 originally estimated for a pad off an existing road suitable for drill access. Drilling costs have escalated from the time the original estimate of $750,000 was made. Analysis of the Brinkerhoff-Signal bid for the rig which has been selected indicates an expenditure of $1,116,000 to drill to a depth of 6000 feet - an increase of $366,000 from the original estimate. Logging will probably cost approximately $73,000 versus the $20,000 estimated. The $75,000 estimated for the flow test is probably correct.

Total actual and estimated costs for the exploration program contemplated in the AMAX-DOE Tuscarora contract are $1,950,800.05 as compared to the $1,129,000.00 originally estimated - an increase of $811,800.05. The majority of this amount, about $780,000, is directly related to increased drilling and drill related costs. At 50% funding for data to be delivered (100% funding for the dipole-dipole and soil Hg geochem surveys), the DOE contracted to share costs amounting to $579,500. Fifty percent of the revised cost of the program, taking into account $20,000 contracted for the dipole-dipole and Hg surveys, equals $981,569.22. Rounding to the nearest one thousand dollars would bring half the revised cost of program to $982,000.

AMAX requests additional funding of $402,500 to a project maximum of $982,000 to cover 50% of the costs related to the surveys necessary to test and explore the geothermal resource potential at Tuscarora.

Option Form 60 is attached as Appendix I.

Invoices of expenditures and details of estimated costs are attached as Appendix II.

AMAX Exploration, Inc.

Gerald J. Kitchen
Vice President

dm

TABLE I

COST AND STATUS OF TUSCARORA SURVEYS

SURVEY	ACTUAL TOTAL COST THRU 1979 $	EST. TOTAL COST IN CONTRACT $	EST. COST TO DOE IN CONTRACT $	REQUESTED DOE SHARE OF COST $	STATUS
Phase I					
Existing Data	8,000.00[1)]	8,000.00[1)]	4,000.00	4,000.00	Data delivered
T shallow	76,948.51	26,000.00	13,000.00	38,474.26	Surveys completed. Partial data delivered
SP	21,368.00	16,000.00	8,000.00	10,684.00	Data delivered
Gravity	22,509.80	4,000.00	2,000.00	11,254.90	Survey complete. Report due January 1980.
MT	33,000.00*	16,000.00	8,000.00	16,500.00*	Survey complete. Report due March 1980.
Dipole-Dipole	31,661.63	15,000.00	15,000.00	15,000.00	Data delivered
Soil Hg Geochem	8,000.00	5,000.00	5,000.00	5,000.00	Samples collected. Awaiting analysis
Phase II					
Air Mag	5,952.11	8,000.00	4,000.00	2,976.00	Data delivered
MEQ	18,860.00	36,000.00	18,000.00	9,430.00	Data delivered
T deep	200,500.00	120,000.00	60,000.00	100,250.00	Survey complete. Data being analysed.
Phase III					
Well Site Prep.	270,000.00*	40,000.00	20,000.00	135,000.00*	Completed
PTW	1,116,000.00*	750,000.00	375,000.00	558,000.00*	Spud in January-February 1980
Logs	73,000.00*	20,000.00	10,000.00	37,500.00*	Spud in January-February 1980
Flow Test	75,000.00*	75,000.00	37,500.00	37,500.00*	(?)Test will be with rig on site
TOTAL	1,950,800.05	1,139,000.00	579,500.00	981,569.22	

1) Assumed cost in contract
* Estimated

CONTRACT PRICING PROPOSAL
(RESEARCH AND DEVELOPMENT)

Office of Management and Budget Approval No. 29-R0184

This form is for use when *(i)* submission of cost or pricing data (see FPR 1-3.807-3) is required and *(ii)* substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO. | NO. OF PAGES

NAME OF OFFEROR AMAX Exploration, Inc.	SUPPLIES AND/OR SERVICES TO BE FURNISHED Geothermal Exploration Logging Well Testing
HOME OFFICE ADDRESS 7100 West 44th Ave. Wheat Ridge, CO 80033	
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED Geothermal Group - Nevada	TOTAL AMOUNT OF PROPOSAL $ 982,000
GOV'T SOLICITATION NO. ET-78-R-08-003	

DETAIL DESCRIPTION OF COST ELEMENTS	ESTIMATED HOURS	RATE/ HOUR	EST COST ($000)	TOTAL EST COST ($000)	REFERENCE
1. DIRECT MATERIAL *(Itemize on Exhibit A)*			EST COST ($)	TOTAL EST COST[1]	REFERENCE[2]
a. PURCHASED PARTS					
b. SUBCONTRACTED ITEMS					
c. OTHER—(1) RAW MATERIAL					
(2) YOUR STANDARD COMMERCIAL ITEMS					
(3) INTERDIVISIONAL TRANSFERS *(At other than cost)*					
TOTAL DIRECT MATERIAL					
2. MATERIAL OVERHEAD[3] *(Rate % X $ base =)*					
3. DIRECT LABOR *(Specify)*	ESTIMATED HOURS	RATE/ HOUR	EST COST ($)		
TOTAL DIRECT LABOR					
4. LABOR OVERHEAD *(Specify Department or Cost Center)*[3]	O.H. RATE	X BASE =	EST COST ($)		
TOTAL LABOR OVERHEAD					
5. SPECIAL TESTING *(Including field work at Government installations)*			EST COST ($)		
see Exhibit A			982		
TOTAL SPECIAL TESTING				982	
6. SPECIAL EQUIPMENT *(If direct charge) (Itemize on Exhibit A)*					
7. TRAVEL *(If direct charge) (Give details on attached Schedule)*			EST COST ($)		
a. TRANSPORTATION					
b. PER DIEM OR SUBSISTENCE					
TOTAL TRAVEL					
8. CONSULTANTS *(Identify—purpose—rate)*			EST COST ($)		
TOTAL CONSULTANTS					
9. OTHER DIRECT COSTS *(Itemize on Exhibit A)*					
10. TOTAL DIRECT COST AND OVERHEAD					
11. GENERAL AND ADMINISTRATIVE EXPENSE *(Rate % of cost element Nos.)*[3]					
12. ROYALTIES[4]					
13. TOTAL ESTIMATED COST				982	
14. FEE OR PROFIT					
15. TOTAL ESTIMATED COST AND FEE OR PROFIT				982	

OPTIONAL FORM 60
October 1971
General Services Administration
FPR 1-16.801

This proposal is submitted for use in connection with and in response to (Describe RFP, etc.)
RF No. ET-78-R-0003 Geothermal Reservoir Assessment Case Study, Northern Basin and Range Province

and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE	SIGNATURE
Harry J. Olson Managing Geologist, Geothermal Exploration	

NAME OF FIRM	DATE OF SUBMISSION
AMAX Exploration, Inc.	January 18, 1980

EXHIBIT A—SUPPORTING SCHEDULE (Specify. If more space is needed, use reverse)

COST EL NO.	ITEM DESCRIPTION (See footnote 5)	EST COST ($)
	FY 1978	
	Phase I - Existing Data	
	Shallow Thermal Gradient and Lith Logs	4
	New Data	
	Shallow Thermal Gradient and Lith Logs	38
	Self Potential Survey	11
	Magnetotelluric Survey	17
	Gravity Survey	11
	Dipole-Dipole	15
	Soil Hg Geochem	5
	FY 1979	
	Phase II	
	Microearthquake Survey	10
	Aeromagnetic Survey	3
	Deep Thermal Gradient and Lith Logs	100
	FY 1980	
	Phase III	
	Well Site Preparation	135
	Production Test Wells	558
	Logs	38
	Flow Test	37
	TOTAL	982

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☐ YES ☒ NO (If yes, identify below.)

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL	TELEPHONE NUMBER/EXTENSION

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☒ YES ☐ NO (If yes, identify on reverse or separate page)

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☒ YES ☐ NO (If yes, identify) ☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT (Or, do you have any independently financed (IR&D) projects) FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

☒ YES ☐ NO (If yes, identify) Tuscarora Prospect DE-AC08-79ET27011

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

☒ YES ☐ NO (If no, explain on reverse or separate page) (to the best of my knowledge)

AMAX EXPLORATION, INC.
A SUBSIDIARY OF AMAX INC.

GEOTHERMAL BRANCH

January 16, 1980

Contracting Officer
Engineering and Energy Applications Division
Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attn: Joseph D. Fiore

Re: McCoy Prospect

Geothermal Reservoir Assessment Cost Study
Northern Basin & Range, DE-AC08-79ET27010

Request for Additional Funding

Dear Joe:

Enclosed is a letter requesting additional funding for the McCoy project. Appendix II, which provides invoices of expenditures and details of estimated costs, is not attached to the request. Appendix II will be forwarded to you as soon as the data can be assembled.

Best regards,

Sincerely,

AMAX EXPLORATION, INC.

Harry J. Olson
Managing Geologist
Geothermal Exploration

dm

7100 WEST 44TH AVENUE, WHEAT RIDGE, COLORADO 80033 • TELEPHONE (303) 420-8100 - TELEX 45-556

AMAX EXPLORATION, INC.
A SUBSIDIARY OF AMAX INC.

GEOTHERMAL BRANCH

January 16, 1980

Contracting Officer
Engineering and Energy Applications Division
Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Attn: Joseph D. Fiore

Re: McCoy Prospect

Geothermal Reservoir Assessment Cost Study
Northern Basin & Range, DE-AC08-79ET27010

Request for Additional Funding

Gentlemen:

AMAX Exploration, Inc., a wholly owed subsidiary of AMAX, Inc. requests additional funding to the contract previously awarded AMAX Exploration by the DOE under the Geothermal Reservoir Case Study - Northern Basin and Range Province: McCoy, Nevada area (Contract No. DE-AC08-79ET27010). Total additional funding requested from the DOE under this contract is $415,500. This will be expended during FY 1980 and FY 1981. The additional funding requested represents 50% of increased costs incurred, or estimated to be incurred, in completing surveys described in the AMAX-DOE McCoy contract. Funding of these surveys at 50% will increase the total estimated cost to the DOE of the program from $594,500 to $1,010,000.

Details of the McCoy program, the area to be covered, data to be delivered, and specifics of AMAX Exploration's qualifications, capabilities, representations, and certifications are given in RFP No. ET-78-R-08-003, McCoy, Nevada Proposal, AMAX Exploration, Inc., which was submitted to the DOE May 30, 1978.

Details of the increased costs are shown on Table I and are further described as follows:

7100 WEST 44TH AVENUE, WHEAT RIDGE, COLORADO 80033 • TELEPHONE (303) 420-8100 - TELEX 45-556

Phase I

As of December 31, 1979 all surveys have been completed. Data has been delivered to the DOE for all surveys except gravity and MT. Results of the gravity survey should be delivered in January, 1980 and the MT survey by May.

Cost of the existing data is $10,000.

Cost of the shallow gradient survey is $18,286.58 - approximately $11,700 less than the $30,000 originally estimated. Drilling conditions were good at McCoy and because of the deep water table it was not necessary to drill as deep as was originally planned. AMAX is experimenting with temperature measurements made at a depth of three meters in holes separate from those used in the shallow gradient survey to determine if the thermal anomaly at McCoy can be readily identified and detailed by shallow, inexpensive measurements. As agreed, this data will be passed on to the DOE at no additional cost.

The SP survey cost $17,902.50 - an increase of almost $2000 from the $16,000 originally estimated. The overrun is due to an underestimation of the time required to complete the survey traverses and reduce the data.

Cost of the gravity survey is $17,449.09 - approximately $11,500 more than the $6000 estimated. The original survey cost is based on the use of an AMAX gravimeter by permanent AMAX staff, which accordng to the contract are not chargeable items, and computer processing of the data by an outside contractor, which is. The gravimeter was damaged and rendered useless in a field accident at the beginning of the survey at McCoy and could not be used for further work. This necessitated the use of a contractor to collect and reduce the gravity data. The increased costs are related to contractor fees and expenses in completing the survey and reporting the results.

Cost of the MT survey is estimated to be $20,000 - an increase of $4,000 from the $16,000 predicted. Estimated cost increases are due to higher operating costs related to newly designed state-of-the-art equipment and difficulty in collecting data under adverse winter weather conditions.

Phase II

As of December 31, 1979, all surveys have been completed, or are in progress. Data from the aeromagnetic and microearthquake surveys have been delivered to the DOE. The deep gradient survey is in progress and should be completed by the end of February. Probing of the wells should be completed by the end of April and the results should be available for delivery to the DOE in June, 1980.

Cost of the aeromagnetic survey is $6,680.66, a savings of greater than $3,000 from the $10,000 estimated. The savings resulted from AMAX combining this survey with several other surveys being flown in 1979 and benefitting in overall lower line-mile costs.

Cost of the MEQ survey is $39,281.75 - approximately $3,300 more than the $36,000 estimated. The estimated cost overrun is due to an underestimation in the time and cost required to reduce the data.

The deep gradient survey is estimated to cost about $360,000 - approximately $240,000 more than the $120,000 originally predicted. The property was brought to Unit on September 11, 1979. The estimated, substantial cost overrun is due primarily to increased costs related to larger hole diameters and casing requirements specified by the U.S. Geological Survey to satisfy unit drilling requirements for geothermal resources indicated by the shallow gradient survey to be at depths on the order of half a kilometer. Some increased costs, mainly concerning rental equipment, are related to drill breakdowns during the drilling and casing of holes #66-8 and #14-7. A substantial portion of drill breakdown costs, however, have been absorbed by the drilling contractor.

Phase III

Work on Phase III activities has not begun as yet. No decision has been made as yet as to the applicability and desirability of a reflection seismic survey. A production test well will not be sited, if at all, until results of the deep gradient wells are analyzed. Some flow test equipment, however, has been rented and incorporated in the well head design of the deep gradient wells to permit testing should geothermal fluids be encountered.

The $70,000 estimated cost of a reflection seismic survey is still considered to be valid.

The deep production test well is estimated to cost approximately $1,200,000 if drilled in late 1980 or early 1981. This could be substantially lower if the PTW is sited on deep gradient well #14-7 which is scheduled to be equipped to be completed as a production well if warranted. Drilling water could increase this total by $50,000 if adequate water cannot be acquired locally. A $1,200,000 cost for the PTW is an increase of $450,000 from the $750,000 originally proposed. Drilling costs have escalated from the time the original estimate was made. Road and well site costs are now estimated to be $100,000. This assumes that the selected drill site will be near one of the existing graded, gravel roads that cross the area, and that the drill pad will not require substantial rock work. Logging will probably cost $75,000 versus the $20,000 estimated. The $75,000 estimated for the flow test is probably correct.

Total actual and estimated costs for the exploration program contemplated in AMAX-DOE McCoy contract are $2,019,600.58 as compared to the $1,189,000.00 originally estimated - an increase of $830,600.58. The majority of this amount, about $813,300 is directly related to increased drilling and drill related costs. At 50% funding for data to be delivered the DOE contracted to share costs amounting to $594,500. Fifty percent of the revised cost of the program equals $1,009,800.29. Rounding to the nearest one thousand dollars would bring half the revised cost of the program to $1,010,000.

AMAX requests additional funding of $415,500 to a project maximum of $1,010,000 to cover 50% of the costs related to the surveys necessary to test and explore the geothermal resource potential at Tuscarora.

Optional Form 60 is attached as Appendix I.

Invoices of expenditures and details of estimated costs are attached as Appendix II.

AMAX EXPLORATION, INC.

Gerald J. Kitchen
Vice President

TABLE I

COST AND STATUS OF McCOY SURVEYS

SURVEY	ACTUAL TOTAL COST THRU 1979 $	EST. TOTAL COST IN CONTRACT $	EST. COST TO DOE IN CONTRACT $	REQUESTED DOE SHARE OF COST $	STATUS
Phase I					
Existing data	20,000.00[1)]	20,000.00[1)]	10,000.00	10,000.00	Data delivered
T Shallow	18,286.58	30,000.00	15,000.00	9,143.29	Data delivered
SP	17,902.50	16,000.00	8,000.00	8,951.25	Data delivered
Gravity	17,449.09	6,000.00	3,000.00	8,724.54	Survey completed, report due January, 1980
MT	20,000.00*	16,000.00	8,000.00	10,000.00*	Survey to start January 1980 Report due May, 1980
Phase II					
MEQ	39,281.75	36,000.00	18,000.00	19,640.83	Data delivered
Air Mag	6,680.66	10,000.00	5,000.00	3,340.33	Data delivered
T Deep	360,000.00*	120,000.00	60,000.00	180,000.00*	Drilling started October 1979
Phase III					
Reflex. Seis.	70,000.00	70,000.00*	35,000.00*	35,000.00*	(?) Spring 1980
Well Site Prep.	100,000.00	20,000.00*	10,000.00*	50,000.00*	(?) FY 1980/81
PTW	1,200,000.00	750,000.00*	375,000.00*	600,000.00*	(?) FY 1980/81
Logs	75,000.00	20,000.00*	10,000.00*	37,500.00*	(?) FY 1980/81
Flow Test	~~75,000.00*~~	~~75,000.00~~	~~37,500.00~~	~~37,500.00*~~	(?) Test will be with rig on site
TOTAL	2,019,600.58	1,189,000.00	594,500.00	1,009,800.29*	

* Estimated

1) Assumed cost in contract

APPENDIX I MC COY

CONTRACT PRICING PROPOSAL

(RESEARCH AND DEVELOPMENT)

Office of Management and Budget Approval No. 29-R0184

This form is for use when *(i)* submission of cost or pricing data (see FPR 1-3.807-3) is required and *(ii)* substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO. | NO. OF PAGES

NAME OF OFFEROR: AMAX Exploration, Inc.

HOME OFFICE ADDRESS: 7100 West 44th Ave. Wheat Ridge, CO 80033

SUPPLIES AND/OR SERVICES TO BE FURNISHED: Geothermal Exploration Logging Well Testing

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED: Geothermal Group - Nevada

TOTAL AMOUNT OF PROPOSAL: $ 1,010,000

GOV'T SOLICITATION NO.: ET-78-R-08-0003

DETAIL DESCRIPTION OF COST ELEMENTS	ESTIMATED HOURS	RATE/ HOUR	EST COST ($) ($000)	TOTAL EST COST ($000)	REFERENCE
1. DIRECT MATERIAL *(Itemize on Exhibit A)*			EST COST ($)	TOTAL EST COST	REFERENCE
a. PURCHASED PARTS					
b. SUBCONTRACTED ITEMS					
c. OTHER—(1) RAW MATERIAL					
(2) YOUR STANDARD COMMERCIAL ITEMS					
(3) INTERDIVISIONAL TRANSFERS *(At other than cost)*					
TOTAL DIRECT MATERIAL					
2. MATERIAL OVERHEAD[1] *(Rate % X $ base =)*					
3. DIRECT LABOR *(Specify)*	ESTIMATED HOURS	RATE/ HOUR	EST COST ($)		
TOTAL DIRECT LABOR					
4. LABOR OVERHEAD *(Specify Department or Cost Center)*[1]	O.H. RATE	X BASE =	EST COST ($)		
TOTAL LABOR OVERHEAD					
5. SPECIAL TESTING *(Including field work at Government installations)*			EST COST ($)		
see Exhibit A			1,010		
TOTAL SPECIAL TESTING				1,010	
6. SPECIAL EQUIPMENT *(If direct charge) (Itemize on Exhibit A)*					
7. TRAVEL *(If direct charge) (Give details on attached Schedule)*			EST COST ($)		
a. TRANSPORTATION					
b. PER DIEM OR SUBSISTENCE					
TOTAL TRAVEL					
8. CONSULTANTS *(Identify—purpose—rate)*			EST COST ($)		
TOTAL CONSULTANTS					
9. OTHER DIRECT COSTS *(Itemize on Exhibit A)*					
10. *TOTAL DIRECT COST AND OVERHEAD*					
11. GENERAL AND ADMINISTRATIVE EXPENSE *(Rate % of cost element No.)*[1]					
12. ROYALTIES[1]					
13. *TOTAL ESTIMATED COST*				1,010	
14. FEE OR PROFIT					
15. *TOTAL ESTIMATED COST AND FEE OR PROFIT*				1,010	

OPTIONAL FORM 60
October 1971
General Services Administration
FPR 1-16.807

This proposal is submitted for use in connection with and in response to *(Describe RFP, etc.)*
RFP No. ET-78-R-08-0003 Geothermal Reservoir Assessment Case Study, Northern Basin and Range Province
and reflects our best estimates as of this date, in accordance with the Instructions to Offerors and the Footnotes which follow.

TYPED NAME AND TITLE	SIGNATURE
Harry J. Olson Managing Geologist, Geothermal Exploration	

NAME OF FIRM	DATE OF SUBMISSION
AMAX Exploration, Inc.	January 18, 1980

EXHIBIT A—SUPPORTING SCHEDULE *(Specify. If more space is needed, use reverse)*

COST EL NO.	ITEM DESCRIPTION *(See footnote 5)*	EST COST ($)
	FY 1978	
	Phase I - Existing Data	
	Shallow Thermal Gradient and Lith Logs	10
	New Data	
	Shallow Thermal Gradient and Lith Logs	9
	Self Potential Survey	9
	Magnetotelluric Survey	9
	Gravity Survey	10
	FY 1979	
	Phase II	
	Microearthquake Survey	20
	Aeromagnetic Survey	3
	Deep Thermal Gradient and Lith Logs	180
	FY 1980 - 81	
	Phase III	
	Reflection Seismic Survey	35
	Well Site Preparation	50
	Production Test Wells	600
	Logs	37
	Flow Test	38
	TOTAL	1,010

I. HAS ANY EXECUTIVE AGENCY OF THE UNITED STATES GOVERNMENT PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☐ YES ☒ NO *(If yes, identify below.)*

NAME AND ADDRESS OF REVIEWING OFFICE AND INDIVIDUAL	TELEPHONE NUMBER/EXTENSION

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☐ YES ☒ NO *(If yes, identify on reverse or separate page.)*

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☒ YES ☐ NO *(If yes, identify.)* ☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT *(Or, do you have any independently financed (IR&D) projects)* FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

☒ YES ☐ NO *(If yes, identify.)* McCoy Prospect, DE-AC08-79ET27010

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN AGENCY REGULATIONS?

☒ YES ☐ NO *(If no, explain on reverse or separate page.)* (To the best of my knowledge)

See Reverse for Instructions and Footnotes

OPTIONAL FORM 60 (10-78)