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Energy & Mineral Research Center

Fuels & Process Chemistry Research Institute
ND Mining & Mineral Resources Research Institute
Combustion & Environmental Systems Research Institute

Box 8213, University Station / Grand Forks, North Dakota 58202 / Phone: (701) 777-5000 / Fax: 777-5181

March 31, 1989

North Dakota Lignite Research Council
Proposal Submissions
400 East Broadway
Bismarck, ND 58501

Dear Sir/Madam:

Enclosed is our proposal for funding under the current Lignite Research Council request for proposals.

The CCT-3 timetable, as dictated by DOE, is such that this prospectus must be completed by May 31, 1989 to be useful to the completion of a CCT-3 submittal in August. Without its availability at that time, an acceptable CCT-3 package will almost certainly not be able to be prepared by the required date. This leaves a very small block of time to develop this important document, which makes the immediate review of this proposal imperative. Any delay will jeopardize what has been acknowledged to be North Dakota's best chance of receiving CCT funding. North Dakota cannot afford to lose an opportunity that has major long-term implications with respect to the state's economy through the innovative utilization of its major energy source.

We believe North Dakota is in an ideal position to respond to an unequalled opportunity for long-term economic growth based on our largest energy reserve. The Energy and Mineral Research Center remains committed to facilitating that end.

If you have any questions or comments, or if we can be of assistance in any manner, please feel free to contact us at your convenience at 701-777-5131.

Sincerely,

Frank W. Beaver
Director, MMRRI
Co-Principal Investigator

Craig R. Schmit
Geologist
Co-Principal Investigator

FWB/amf
Enclosure
c: Governor George Sinner
Mylo Candee
President Tom Clifford
Dean Alan Fletcher
Gerald Groenewold
Michael Jones
Everett Sondreal
Kent Janssen
Don Pollock

DEVELOPMENT OF A PROSPECTUS FOR AN UNDERGROUND COAL GASIFICATION DEMONSTRATION PROJECT NEAR BEULAH, NORTH DAKOTA

Submitted to:

North Dakota Lignite Research Council
400 East Broadway
Bismarck, ND 58501

Submitted by:

ND Mining and Mineral Resources Research Institute
Energy and Mineral Research Center
P.O. Box 8213, University Station
Grand Forks, ND 58202

Period of Performance: 4/01/89 - 5/31/89

Craig R. Schmit
Co-Principal Investigator

Frank W. Beaver
Co-Principal Investigator

Alex Kotch, Director
Office of Research and Program
Development

TABLE OF CONTENTS

OBJECTIVES

The overall objective of the proposed work is to prepare a prospectus for a long-term, multi-well underground coal gasification (UCG) demonstration project in the vicinity of the Great Plains surface gasification facility in Mercer County, North Dakota. This demonstration project will be the focus of an August, 1989 submittal to the U.S. Department of Energy (DOE) for third-round funding under the Clean Coal Technology Program (CCT-3). The prospectus will:

1. Provide a basic description of this demonstration project;
2. Provide a detailed rationale for this demonstration project;
3. Provide an in-depth discussion of the advantages of siting this project near the Great Plains plant;
4. Identify the goals of this project;
5. Identify the requirements for the successful development of a CCT-3 submittal for this project; and
6. Provide a basis upon which to solicit cofunding and other support, as well as technical participation in this project.

BACKGROUND

Underground coal gasification (UCG), which refers to the controlled burning of unmined coal to produce natural gas, has been tested since the 1920's as a potential coal-utilization alternative. UCG has continued to receive attention, even during periods of abundant and cheap natural gas from conventional sources, primarily because it remains the most promising strategy for utilizing coal resources uneconomical to recover by means of conventional technologies. It is particularly attractive to a state such as North Dakota, whose lignite resources are presently only economically recoverable by surface-mining techniques applicable to less than ten percent of its known coal reserves. The successful commercialization of UCG would potentially allow the utilization of much of the remaining 90 percent of North Dakota's coal, which would serve to broaden the state's energy-related economic base. Coal utilization by UCG would provide coal companies in the state and other mineral holders with a special opportunity, since, by nature of their holdings, they already control large quantities of otherwise unrecoverable coal. Moreover, the North Dakota coal industry would have the additional advantage of already employing people with most of the expertise necessary to successfully gasify coal in-place.

The recent history of UCG research indicates that there is excellent potential for its commercial application, though on a scale that is yet to be determined. Domestically, this research has largely been done in the context of a series of federally- and industrially-funded field tests involving low-rank coals in Wyoming. This series was initiated in the early 1970's, and was continued with the ongoing Rocky Mountain 1 (RM1) UCG test program in south-

central Wyoming. The RM1 test, which was designed to simultaneously evaluate two innovative gasification technologies, is typical of the preceding tests in the series in that: 1) it involves a limited number of process wells, and, therefore, is a much smaller operation than commercial development would require, and 2) its scheduled duration is very short relative to the projected life of any commercial UCG operation. The limited scale and duration notwithstanding, it is generally acknowledged that the Wyoming tests to date have collectively demonstrated that the UCG process can be initiated and controlled to produce acceptable quantities of medium-Btu natural gas. At the same time, the UCG research community recognizes that: 1) a long-term test involving substantially more wells is essential if progress toward establishing the commercial-scale efficiency, economy, and environmental-acceptability of this promising coal-conversion technology is to be maintained, and 2) such a test must be designed and conducted in response to a comprehensive, fundamental understanding of the setting within which it is to take place. This second imperative is a response to the design problems that have often been encountered in past tests, and which can generally be attributed to either: 1) critical inadequacies in pre-test characterization of the geological, geochemical, geotechnical, and hydrogeological aspects of the test setting, or 2) a failure to consider existing knowledge of these aspects in test design and conduct.

Two major problems have thus far prevented the operation of a long-term, multi-well UCG test, namely, the disposition of the large quantities of gas that such a test would produce, and the high costs that such a test would involve. These problems have recently been addressed in a University of North Dakota Energy and Mineral Research Center (UNDEMRC) proposal for a long-term, multi-well UCG test to be conducted near the Great Plains surface gasification

facility in Mercer County, North Dakota. According to the tentative project design, which would allow the utilization of coal not otherwise recoverable, the gas produced could possibly be provided to Dakota Gas Company to offset potentially valuable byproduct streams currently being burned, while serving as a backup source of gas should production problems be encountered in the surface facility. In addition, siting of the test near the Great Plains facility appears to provide a setting that is uniquely well-suited, both geologically and hydrogeologically, for a UCG test involving many wells over a long period. Specifically:

1. North Dakota lignite, although it hasn't been the focus of a UCG field test, has several properties that should make it an ideal feedstock, including:

    a. its high moisture content, which is beneficial in view of the large amount of water required for efficient gasification,

    b. its high reactivity, which is beneficial in promoting the efficient utilization of the available coal during gasification, and

    c. the continuity of, and general lack of faulting in, North Dakota lignite beds;

2. There are indications of several lignite beds of sufficient thickness and continuity at appropriate depths for a long-term, large-scale UCG test in the vicinity of the Great Plains plant;

3. The area of interest appears to have sufficient groundwater resources to support a UCG test on the scale proposed without significantly impacting local users; and

4. The character of the overburden in the area of interest indicates that it will not adversely impact gasification in any substantive way, nor will it likely promote subsidence.

In order to begin an in-depth evaluation of the siting of a long-term, large-scale UCG test in association with the Great Plains gasification operation, the NDEMRC submitted a proposal to the North Dakota Lignite Research Council (NDLRC) in February, 1988, for funding a first-level

feasibility study based on available data. That project, for which funding was recently made available, is designed to:

1. Locate and collect all available site-related data that are significant in the design and conduct of a long-term, multi-well UCG test;

2. Identify the potential relationships between the collected data and the proposed test;

3. Formulate a supplemental site-characterization program to generate key, presently-unavailable, site-related data, though not within the context of this proposal; and

4. Formulate recommendations regarding the design and conduct of the proposed test.

During the eleven-month period that included first the review of that proposal and then the completion of the contract making funding available, discussions continued concerning a long-term, large-scale UCG test in North Dakota. These discussions have involved DOE, the Dakota Gasification Company, the Governor's office, several state agencies, North Dakota's congressional delegation, and a variety of individuals and entities that have been involved in UCG research and development. This interchange has revealed a high level of interest in a UCG test, of the type described, being conducted in the very near future, as well as a growing recognition that the Beulah area, with its strategic advantages, is the most favorable place to do it. Moreover, it has become increasingly evident that such a test is an ideal candidate for inclusion in DOE's Clean Coal Technology (CCT) program in spite of the fact that the original program framework would not readily allow for its consideration. DOE, recognizing this and other shortcomings, has recently moved to institute program modifications that will make it possible for the consideration of a UCG-related proposal in the upcoming third round of submittals (CCT-3).

The call for CCT-3 proposals is scheduled for May of this year, with the deadline for submittals in August. In view of the positive program changes that are pending and the wide-ranging enthusiasm for a long-term, large-scale UCG test in the vicinity of the Great Plains surface gasification plant, a decision has been made to prepare a CCT-3 submission focused on the design and conduct of such a test. In order to build upon the LRC-funded activities already under way and ensure timely progress toward a completed CCT-3 submission under this very tight schedule, it is imperative that a prospectus, designed to formally summarize the project in question, be developed no later than May 31. This prospectus is fundamental to the process of bringing together the necessary industrial partnership, generating the co-funding, and assembling the technical expertise necessary to undertake a project of this scale under CCT-3. The additional detail required for such a document with respect to basic test design, siting, personnel, funding, etc. will be developed largely in response to: 1) a careful evaluation of the characterization data acquired during the presently-funded activities, which will necessarily be accelerated, and 2) more in-depth discussions, particularly with individuals and groups that have been involved in UCG field tests, but also with those who have the potential to contribute to UCG research and development in both the short- and long-term.

GOALS

This project is designed to achieve several goals, the final one of which is the development of the proposed prospectus. These goals include:

1. The collection of technical information necessary to initiate the overall program design;

2. The solicitation of participation in the design and conduct of the proposed test;

3. The solicitation of monetary, in-kind, and expressed support necessary for this project to be the focus of a successful CCT-3 submittal; and

4. The integration of the results of "1", "2", and "3", together with the results of the ongoing NDLRC-funded site-characterization activities, to develop a prospectus for this project as a candidate for CCT-3 funding.

METHODS

The development of the proposed prospectus will first involve the acceleration of the NDLRC-funded UNDEMRC site-characterization effort presently underway. This acceleration is absolutely critical for the following reasons:

1. Development of the proposed prospectus requires the evaluation of available site-related data that is the focus of the ongoing work;
2. The supplemental site-characterization program that will result from that work must be available soon enough to complete the program prior to the CCT-3 submission in August; and
3. The recommendations regarding test design and conduct that will also result from that work must likewise be available for consideration while completing the CCT-3 submission.

The site-characterization effort can be accelerated by narrowing the focus of activities to one or two specific tracts selected by the Dakota Gasification Company in the vicinity of the Great Plains facility, and by the cooperation of Dakota Gasification personnel in making their site-related data available in as timely a manner as possible. Focusing on one or two potential sites will also allow increased efficiency in locating, obtaining, and evaluating relevant data from other sources, which were discussed in detail in the previously funded proposal.

While the pace of the ongoing work will be quickened, the scope of that work will also be expanded in order to gather information critical to initiating the overall program design. For this purpose, information will be required on a wide variety of topics, including specific UCG technologies; process-well drilling and siting; process-data acquisition; process monitoring and control; the sampling and analysis of gas, condensates, tars, and

particulates; and relevant regulatory requirements. This information will be derived, in part, from searches of literature that is specific to UCG, as well as related literature. Most of the UCG literature that will be required is already available in UNDEMRC files, where it has been assembled as part of the previously noted long-term, GRI-funded research effort related to the recent RM1 UCG test in Wyoming. Other literature will be accessed by means of traditional search methods. Additional technical input will be acquired through discussions with individuals that have been actively involved in UCG research, as well as with researchers and industry personnel in other fields as appropriate. A series of contacts will be made in order to solicit:

1. Active participation in the areas of test design and conduct; and
2. Support, either in the form of: a) monetary or in-kind support that can be used as cofunding as required by DOE for a CCT project, or b) expressed support for the project, both in the context of the CCT Program and in the context of the potential for the enhanced utilization of lignite in an economical, efficient, environmentally-acceptable manner.

The individuals and groups to be contacted for participation are being chosen on the basis of demonstrated expertise either in some facet of UCG research and development, or in some related area of science or engineering that will allow them to make a worthwhile contribution to the proposed test. These contacts will be made primarily by UNDEMRC researchers.

Contacts to engender support of all types will be directed toward: 1) the mining and utility industries in North Dakota, whose across-the-board support is indispensable to the success of this venture; 2) entities from other gas-related industries such as pipeline and processing companies; and 3) industry-related groups such as the Gas Research Institute. These contacts will be made as part of an integrated effort that will involve Senator Conrad, Governor Sinner, the Dakota Gasification Company, and UNDEMRC.

The information gained through the initial characterization work, as well as through the contacts, will then be integrated into a basic project description, which will form the core of the proposed prospectus. In addition to this basic description, the prospectus will also include: 1) a more detailed rationale for the test than has yet been presented; 2) an in-depth discussion, utilizing site-specific data, of the advantages of siting this project near the Great Plains facility; 3) a summary of the short- and long-term goals of this project; and 4) a list of specific needs with respect to funding, personnel, test design, etc., for the successful development of a CCT-3 submittal for this project.

TIMETABLE

The CCT-3 timetable, as dictated by DOE, is such that this prospectus must be completed by May 31, 1989 to be useful to the completion of a CCT-3 submittal in August. Without its availability at that time, an acceptable CCT-3 package will almost certainly not be able to be prepared by the required date. This leaves a very small block of time to develop this important document, which makes the immediate review of this proposal imperative. Any delay will jeopardize what has been acknowledged to be North Dakota's best chance of receiving CCT funding. North Dakota cannot afford to lose an opportunity that has major long-term implications with respect to the state's economy through the innovative utilization of its major energy resource.

PERSONNEL

Dr. Frank W. Beaver - Dr. Beaver is presently Director of the North Dakota Mining and Mineral Resources Research Institute (NDMMRRI) of the University of North Dakota Energy and Mineral Research Center, and Assistant Professor of Geological Engineering in the UND Department of Geology and Geological Engineering. He has a varied educational background encompassing chemistry, engineering, and geology, and has a wide variety of professional experience utilizing all three disciplines. Specifically, Dr. Beaver developed a working familiarity with all major regulatory and technical aspects of a range of environmental concerns in the northern Great Plains as the North Dakota/South Dakota State Engineer for the U.S. Environmental Protection Agency for nine years. Subsequently, he has been involved in NDMMRRI research primarily concerned with the characterization of shallow-groundwater systems and the evaluation of impacts on those systems by energy-resource exploration techniques and the disposal of coal-conversion wastes. Dr. Beaver is also active in coal-waste characterization and utilization work through the NDMMRRI's Coal By-Products Utilization Laboratory. As the result of his recent research efforts, he has developed considerable expertise in the application of computer capabilities and techniques to groundwater-related problems in particular. Dr. Beaver's full range of expertise is presently being applied to the conduct of a variety of site-characterization, technical assistance, and research activities that are part of the NDMMRRI's long-term involvement in the ongoing Rocky Mountain 1 UCG test in Wyoming.

Mr. Daniel J. Daly - Mr. Daly, a geologist with the North Dakota Mining and Mineral Resources Research Institute (NDMMRRI) of the University of North Dakota Energy and Mineral Research Center, holds a Master of Science degree in Geology from the University of North Dakota. Through his involvement in a series of projects concerning the impacts of mining and waste disposal on the environment in the northern Great Plains, Mr. Daly has become familiar with the geology and hydrogeology of the shallow subsurface in the Williston basin, as well as with the siting, installation, and uses of groundwater instrumentation. He also has resource-evaluation experience gained through participation in the NDMMRRI's long-term program to comprehensively reevaluate North Dakota's coal resources. Finally, Mr. Daly has been involved in several fundamental studies of the geology of the coal-bearing sediments of the northern Great Plains, as well as in the geological characterization phases of other NDMMRRI projects, including the long-term project related to the ongoing Rocky Mountain 1 underground coal gasification test in Wyoming.

Dr. Gerald Groenewold - Dr. Groenewold, former Director of the North Dakota Mining and Mineral Resources Research Institute (NDMMRRI), is presently the Director of the University of North Dakota (UND) Energy and Mineral Research Center, as well as an Associate Dean in the UND School of Engineering and Mines and an Associate Professor in the UND Department of Geology and Geological Engineering. He is a recognized authority on the geology of the surface and near-surface sediments in the northern Great Plains, as well as on the hydrogeology and hydrogeochemistry of northern Great Plains shallow-groundwater systems. His research in these areas has focused on sediment mineralogy, geochemistry, trace-element attenuation properties and buffering capacities, in addition to surface-coal-mine reclamation practices, and the

impacts of surface coal-mining and the disposal of coal-conversion and oil-and-gas drilling wastes on groundwater. Dr. Groenewold also has more than ten years of research experience in the characterization and management of wastes, particularly fly ash, from coal-fired power plants and the nation's only commercial, large-scale coal-gasification plant. His extensive experience in designing and managing projects that are typically multi-disciplinary and often multi-institutional is exemplified in the NDMMRRI's long-term involvement in the environmental program of the ongoing Rocky Mountain 1 UCG test in Wyoming. Dr. Groenewold is both project administrator and principal investigator for that project, which consists of a wide range of site-characterization, technical-assistance, and research activities.

Mr. Craig R. Schmit - Mr. Schmit, geologist and Assistant to the Director of the North Dakota Mining and Mineral Resources Research Institute (NDMMRRI) of the University of North Dakota Energy and Mineral Research Center, was trained in Geology, and, prior to his employment by the NDMMRRI seven years ago, he gained a wide variety of professional experience in energy-resource exploration and evaluation, as well as in geological characterization. This experience resulted from industry employment, as well as from research in a variety of academic settings. Moreover, he was involved in research to investigate the potential hazard of selected waste streams, as well as in metals-extraction research, at the (US) Bureau of Mines Salt Lake City research facility. Since coming to the NDMMRRI, Mr. Schmit has been a principal figure in the comprehensive reevaluation of North Dakota's coal resources and in NDMMRRI research activities related to the geology of the coal-bearing sediments in the northern Great Plains. Furthermore, he has participated in a number of other NDMMRRI research projects, with much of his

involvement focused on geological characterization activities. Presently, Mr. Schmit is also both coordinating and taking an active part in the site-characterization, technical-assistance, and research activities related to the NDMMRRI's long-term involvement in the ongoing Rocky Mountain 1 underground coal gasification test in south-central Wyoming.

APPLICANT QUALIFICATIONS

The following summary, prepared some time ago at the request of our GRI project manager: 1) reviews the activities that the UNDEMRC has been and will be involved in during the course of our long-term participation in the RM1 UCG test program in Wyoming, and 2) provides a rationale for the design and conduct of those activities. This summary serves to illustrate many of our qualifications for performing the work proposed herein.

The underground gasification of coal both affects and is affected by the geological, geochemical, geotechnical, and hydrogeological character of the setting within which it takes place. Without a fundamental understanding of the complete range of those site characteristics and their relationship to the UCG process, the design and conduct of efficient, economical, and environmentally-acceptable UCG operations is not possible. In essence, UCG-related environmental research activity must not only address regulatory issues and mandates, but also must generate key fundamental test-site information which will allow theoretical, rather than empirical, UCG process design, as well as generic transferability of that design to potential UCG sites. In turn, without UCG tests that focus on a fundamental understanding of both process and environmental issues, the timely development of UCG as an acceptable energy-production alternative cannot continue. The overall RM1 environmental program, funded largely by GRI, is the most comprehensive effort to date to: 1) characterize a UCG site, 2) evaluate how and to what extent key site characteristics affect and are affected by the test burn, and 3) evaluate strategies for dealing with potential environmental impacts.

The long-term involvement of the UNDEMRC in the RM1 environmental program complements and supports the RM1 process-design and environmental activities of the other major participants, Stearns-Roger (S-I) and the Western Research Institute (WRI), by providing critical site-characterization data, project overview technical assistance to the GRI project officer, and important research activities not provided for in the original program.

The UNDEMRC technical-assistance activities are designed to aid the project manager in maintaining the quality and scope of all of the program's tasks at a level necessary to meet the overall objectives in a timely fashion. These tasks include:

1. The monitoring and evaluation of S-I/WRI activities;

2. The subcontracting of a longwall-mining expert for input regarding cavity development and overburden stability;

3. The preparation and submittal of information on topics relevant to, but not provided for in, the original program at the request of the project officer;

4. The evaluation of the UCG-related documents in the GRI Coal Gasification EH&S Information System, and the review of additional related documents for entry into that system;

5. The review of four recently-generated computer models with respect to their application to UCG, and, in particular, to the RM1 UCG test;

6. The completion, in cooperation with WRI, of a key document entitled "Environmental Site Characterization Methodology to Determine UCG Feasibility;" and

7. The coordination of the synthesis of the information generated by all RM1 environmental program activities. This synthesis will be the basis for a major final report. This report will be critical to the adaptation of GRI's RM1 environmental program to future UCG tests, as well as to the development of siting and process-design strategies for future tests.

The UNDEMRC research activities, the inclusion of which were a critical factor in the approval of environmental-related test permits by the Wyoming Department of Environmental Quality, include:

1. Chemical characterization of water in the unsaturated zone, which is vital to the identification of key chemical processes that control groundwater quality at the RM1 site;

2. Determination of temperature profiles in the overburden before, during, and after the test burn, which is important in evaluating and modeling cavity growth and overburden stability, as well as post-burn groundwater movement and quality;

3. Mineralogical, chemical, and, in some cases, organic characterization of: (a) unaltered sediments typical of those surrounding the RM1 target coal, (b) sediments typical of those surrounding the RM1 target coal, as well as the inorganic fraction of the target coal, all thermally-altered in the laboratory under simulated UCG conditions, and (c) solid residues from the Tono, Washington, UCG test, WRI reactor tests, and the RM1 test itself. These characterization activities are important in evaluating and modeling cavity growth and overburden stability, burn-related thermal transformations, and post-burn groundwater movement and quality;

4. Leaching characterization of RM1 solid test-residues, which will contribute to an understanding of post-burn groundwater quality, as well as to the design and evaluation of UCG-related groundwater protection and restoration strategies; and

5. Characterization of the attenuation capacity of sediments surrounding the RM1 target coal, which is critical in evaluating and modeling the intrinsic ability of those sediments to mitigate potential test-related inorganic contaminants. This, in turn, is essential to the design and evaluation of UCG-related groundwater-protection and groundwater-restoration strategies.

The RM1-related UNDEMRC site-characterization, technical-assistance, and research activities are carefully designed to maximize GRI's RM1 environmental-assessment effort by utilizing an integrated, multidisciplinary approach focused on questions that will lead to: 1) a fundamental and generic understanding of the nature, degree, extent, and duration of potential UCG-related environmental impacts, and 2) insights into ways in which those impacts may be avoided or managed in the future. In turn, those data will be critical to evaluating the results of the RM1 test and process designs, and will provide the information essential to the determination of the generic applicability of those process designs to other potential UCG sites. It is the view of a wide range of informed researchers, regulators, and industry

representatives, that without this comprehensive approach focused on both process and environmental issues, the continued development of UCG as a safe, efficient means of producing natural gas is in considerable jeopardy.

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In addition to this ongoing involvement in UCG research, the UNDEMRC through the North Dakota Mining and Mineral Resources Research Institute, has a long history of involvement in research focused on the lignite-bearing region of North Dakota. This research has included a wide variety of projects related to the evaluation, characterization, production, and utilization of North Dakota's coal resources, as well as mined-land reclamation, coal-related waste characterization and management, and groundwater in coal-related settings. Furthermore, the other institutes of the UNDEMRC provide additional extensive engineering, scientific, and analytical expertise, much of it in the areas of coal characterization, utilization, and process chemistry. All of this expertise is applicable at some level to a large-scale, long-term UCG test in North Dakota, and makes the UNDEMRC the most appropriate, best-qualified group to take the lead in the development of the proposed prospectus.

UNDERGROUND COAL GASIFICATION FEASIBILITY PROGRAM
PROPOSAL BUDGET (PHASE II FUNDING)

LABOR	LABOR CATEGORY	HOURLY RATE	HOURS	$ COST
C. SCHMIT	GEOLOGIST III	$16.35	200	$3,270
G. GROENEWOLD	PRINCIPAL SCIENTIST	$31.25	80	$2,500
D. DALY	GEOLOGIST II	$13.23	200	$2,646
F. BEAVER	RES. SCIENTIST III	$25.00	80	$2,000
----------	WORD PROC/GRAPHICS	$7.25	120	$870
----------	STUDENT ASSISTANT	$7.50	160	$1,200
DIRECT LABOR			840	$12,486
FRINGE BENEFITS AS % OF DIRECT LABOR		24%		$2,997
RES. SUPPORT AS % OF DIRECT LABOR *		69%		$8,615
TOTAL LABOR BASED CHARGES				$24,098
OTHER DIRECT COSTS				
TRAVEL				$3,000
OPERATING SUPPLIES INCLD. RAW MATERIALS				$1,000
COMMUNICATION - PHONES AND POSTAGE				$500
TOTAL OTHER DIRECT COST				$4,500
TOTAL DIRECT COST = LABOR BASED + OTHER DIRECT				$28,598
INDIRECT COST - % OF MTDC*			21.9%	$6,263
TOTAL REQUESTED FROM ND LIGNITE COUNCIL				$34,861

*SEE BUDGET NOTES IN THE PROPOSAL

BUDGET NOTES-ENERGY & MINERAL RESEARCH CENTER

The proposed work would be done on a time and materials basis. The distribution of costs between budget categories (labor, travel, supplies, equipment, subcontracts) is for planning purposes only. The principal investigator may, as dictated by the needs of the work, reallocate the budget among approved items or use the funds for other items directly related to the project, subject only to staying within the total dollars authorized for the overall program. Financial reporting will be at the total project level.

Engineering Overhead

1) Research Support

Administrative and facility support expenses directly related to the operations of the University of North Dakota Energy & Mineral Research Center are allocated on the pro rata basis to each contract. The distribution of these direct costs is reflected under research support, which is applied against salaries and wages. The pro rata allocation is adjusted annually as of July 1st for the upcoming fiscal year. The rate of 69% which became effective July 1, 1987 was used in this proposal.

2) Fringe Benefits

Fringe benefits are estimated at 24% of direct labor. This rate is based on historical data. Actual fringe benefit costs will be charged. Non-productive time (vacation, sick leave, and holidays) are not included in the fringe benefits, but they are included in research support.

COMPLEMENTARY FUNDING

The awarded funding total of $34,861 is complemented by in-place UCG-related funding to the UNDEMRC from the Gas Research Institute (GRI) totaling $1,265,945 for the period 10/15/86 - 12/31/92. This GRI funding is applicable to a wide variety of site-characterization, technical-assistance, and research activities related to the Rocky Mountain 1 (RM1) UCG test program in Wyoming. The GRI funding of UNDEMRC research related to the RM1 UCG test provides an appropriate and more than adequate match for the funding requested here because of the UNDEMRC's long-term and wide-ranging involvement in that test. In addition, because of the UNDEMRC's extensive research experience in various topical areas related to coal-bearing strata in the northern Great Plains, the UNDEMRC has been able to design their Wyoming research program so that the RM1 test data will have direct applicability to the proposed Great Plains test site. The RM1 test allows the UNDEMRC to:

1. Participate in the development of, and have access to, UCG site-characterization and technology data bases, both of which are, in large part, generically transferable to the proposed Great Plains test site;

2. Develop a substantial UCG-related experience base, which will, in large part, be directly applicable to the conduct of the activities proposed herein; and

3. Develop UCG-related contacts and a familiarity with the UCG-related literature that will be invaluable in meeting the objectives of this proposal.

In essence, without the experience and data that the UNDEMRC brings to the proposed effort as the result of its involvement in the RM1 program, the prospectus simply could not be developed, and more significantly, a CCT-3

submission focusing on a long-term, large-scale UCG test in North Dakota could not be seriously considered.