METHANE RECOVERY FROM COALBEDS 79-1

- Collection and Utilization Systems -

MONTHLY PROGRESS REPORT

January 1979

UCRTL # C445

Contract No. DE-AC21-78MC08089

TRW

ENERGY SYSTEMS·PLANNING DIVISION
7600 Colshire Drive
McLean, Virginia 22101

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1.0 SUMMARY

This is the monthly report for January 1979 as required under TRW Contract No. DE-AC21-MC08089 to implement the engineering and integration effort necessary to perform the Methane Recovery from Coalbeds Program. This report covers activities during January 1979.

Activities during this reporting period have been directed primarily to:

- Resource Engineering of Unminable Coalbeds. Testing of a Belco Petroleum Corporation well in Sublette County, Wyoming was completed. Gas shows were good, and desorption of cores is currently in work.

  A Resource Delineation Review Meeting was held in Golden, Colorado January 31, 1979.

- Technology Test Projects. The initial draft of the report documenting the basis for the selection of the four candidate projects is under review.

  Instructions for the structuring of the tasks in a standardized form have been provided to the candidate project subcontractors.

  A meeting was held with Occidental Research to review proposed test project agreements.

- Maurer Turbodrill. Formal, Phase I testing of the flow-through bearing pack turbodrill is scheduled for the week of February 19, 1979.

- Semi-Annual Report. This is currently undergoing METC review.

2.0 INTRODUCTION

2.1 BACKGROUND

Methane, the major component of natural gas, is generated during the natural process of coal formation. Frequently, because of the low permeability of strata associated with coalbeds, it is trapped in the coal and associated strata. The total magnitude of the U.S. coal-associated methane resource has been estimated at approximately 700 trillion cubic feet (700 quads). Given current and conservatively projected economic and technological factors, the recovery of some 300 trillion cubic feet of this resource appears to be feasible.

During mining operations in an underground mine, the removal of coal provides a free volume into which the methane can migrate and mix with air to form a potentially explosive or flammable mixtrue. The most widespread method of controlling methane concentrations to safe levels is dilution with ventilating air which sweeps the methane from the mine into the atmosphere. This is an expensive and relatively inefficient method of control.

The U.S. Bureau of Mines and many mining companies have been investigating techniques for draining methane from coalbeds to prevent gas migration into the working area. These techniques investigated include drilling vertical or directional wells into virgin coalbeds in advance of the mine's working faces, and drilling horizontal boreholes into virgin coalbeds from a central shaft or heading. These drainage methods produce natural gas comparable to that from other gas reservoirs. Drainage from gob areas may be accomplished through vertical wells which provide gas diluted with air with mixtures ranging from 25 to 90 percent methane. Such techniques will significantly reduce ventilation requirements necessary to maintain methane concentrations at a safe level and at the same time improve mining productivity by reducing downtime caused by hazardous levels of methane.

It has been estimated that mines in the Pittsburgh coal seam are currently producing over 100 million standard cubic feet of methane per day. The expansion of coal mining over the next 10 years, together with extensive adoption of predraining and gob draining techniques, will increase these amounts considerably. At present, no commercial use is being

made of this potential resource; the gas is wasted. The serious gas shortages and curtailment of industrial activity during the past winters emphasize the importance of utilizing this gas.

Preliminary studies indicate the feasibility of recovering and utilizing this resource profitably. The ranges of quantitative availability, gas quality, and geographic location of coalbed methane make it clear that no single solution is appropriate for all cases. The referenced studies indicate a high probability of economic gas recovery/utilization for several approaches, including: direct pipeline injection; LNG production; on-site power generation; heating applications; and petrochemical production. The technology necessary to use this valuable resource exists today, although some modification may be required to accommodate the requirements of this application.

2.2 METHANE RECOVERY FROM COALBEDS PROJECT

In order to avoid the waste of methane contained in coalbeds and to provide for its recovery and utilization, the Department of Energy has initiated the Methane Recovery from Coalbeds Project to be implemented through the Morgantown Energy Technology Center. The near-term objective of the project is to develop through technology test projects methane from coalbeds recovery and utilization. The results of the projects will be the dissemination of information to industry, leading to widespread commercial utilization of a significant gas resource now being wasted. Long-term objectives are expanded recovery and utilization from large, unminable coal deposits and the development of equipment for conversion/utilization specifically for coalbed methane applications.

In December of 1977, TRW initiated work under Contract No. DE-AC21-78MC08089 to implement the systems engineering and integration effort necessary to performing the Methane Recovery from Coalbeds Project. The systems integration activities will assure that:

- Coalbed methane resources are identified, classified, and ranked
- Systems configurations to be demonstrated are selected on the basis of an evaluation of pre-selected criteria
- Potential resource subcontractors are identified and final selections made based on evaluations that will best fulfill program and project objectives

- Design, site preparation and operation are coordinated for cost effective implementation

- Data analysis, results, etc., are performed to the required detail and all information disseminated to the private sector by methods determined necessary to assist in their project planning and implementation on a commercial basis, including data in handbook format suitable for use by any engineer.

The TRW contract requirements and approach are discussed in Section 3. Work accomplished during January is described in Section 4. Work planned for February is discussed in Section 5. A schedule and an expenditure chart are provided in Section 6.

3.0 TECHNICAL APPROACH

3.1 INTRODUCTION

The primary objective of the Methane from Coalbeds Program is to develop and demonstrate a set of conditions in which recovery and utilization of coalbed methane is clearly to the economic advantage of the relevant private sector interests and which minimizes the necessity for Federal involvement over an extended time period. The TRW approach is established to meet this objective and features:

- Resource characterization to identify target sites with greatest potential
- Identification of R&D to improve recovery and utilization techniques
- Definition, selection, and implementation of systems application projects to verify technical and economic viability under a variety of field conditions
- Technology transfer sufficient to support extensive commercialization of coalbed methane
- Overall program integration to assure a coordinated effort.

3.2 TRW SCOPE OF WORK

Performance is to be accomplished in three phases, as follows:

a. Phase I - System Preliminary Design, Development and Analysis.

Conduct the necessary analysis, design and development activities to develop a detailed demonstration plan. The estimated performance time for Phase I is six months. In connection, therewith:

1) Acquire necessary data and information to define a suitable site for the first field demonstration. This site shall be limited to "minable" coalbeds. Provide for a central data base/information system plan for the entire Methane from Coalbeds Program. Resource delineation for unminable coalbeds as well as minable coalbeds is to be a part of this effort.

2) Provide field work necessary to meet the requirements of Item 1, including drilling and site surveying

3) Prepare a program plan for the recovery of coalbed methane. The plan should include objectives, scope, funding, and schedules. This effort will include program planning analysis and formulation assistance to METC/DOE. It requires monitoring, oversight and technical surveillance of various contracts in the Methane Recovery from Coalbeds Project.

4) Provide for, and conduct, technology transfer

5) Prepare a preliminary system design for the first field test demonstration

6) Prepare and submit a proposal for the Phase I options

7) Update the Phase II cost estimate for the first field test demonstration

8) Conduct an oral presentation of all results to the Technical Project Officer at METC at the conclusion of Phase I.

b. Phase II - Detailed Design and Analysis (Optional).

Complete all analyses for the preparation flow sheets, site layout plans, safety plans, and collection and analysis plans. The estimated performance time for Phase II is six months. In connection, therewith:

1) Provide a detailed system design, installation drawings and specifications for the first "minable" coalbed test site demonstration

2) Update the Phase III cost estimate.

c. Phase III - Site Preparation and Operation (Optional).

Proceed with this phase of effort in accordance with the plans which are approved under the Phase II report. In connection with Phase III:

1) Proceed with site development and procurement of long-lead items

2) Initiate site operations and evaluate test results. Provide data analysis, technology transfer and cost benefit analysis.

3.3 TRW STATEMENT OF WORK

Initial funding provided for the following specific work and the basis for negotiating other work included in the overall scope with funding to be provided as the program progresses and is approved by DOE/METC.

a. Phase I

1) Provide for a central data base/information system plan for the entire Methane Recovery from Coalbeds Project. This will include data from "minable" coalbeds as well as data from "unminable" coalbeds. This will require updating the existing data base and developing a data base on coalbeds not previously evaluated. This will provide the project with common source technical and economic data from reliable sources, current and traceable, and generally accurate. The

plan will provide for a data base by coalbed, categorization of coalbeds, methane source criteria, and methane resource analysis and evaluation. Based on the available data, additional data generated through drilling surveying, and the necessary evaluation, propose a "minable" field test site suitable for demonstrating methane extraction from coalbeds and utilization technologies. Rationale for the proposed site will be provided, i.e., the potential subcontractors will be identified, evaluated, and ranked.

2) Prepare a program plan for the Methane Recovery from Coalbeds activities. The plan will be prepared to describe and prescribe the goals, strategy, structure, schedules, funding requirements, and management of the program.

3) Prepare a technology transfer plan and initiate program data dissemination.

4) Provide a preliminary system design, installation drawings and specifications for the development of the proposed first site. A requirements analysis and assessment will be performed that will result in a synergistic design concept giving proper attention to the process economics, transferability of generated data, and environmental aspects of the installed equipment. Requirements will be identified and analyzed for site preparation, process equipment, environmental, safety, regulatory/legal, use/market, and economics.

5) Provide an updated cost estimate for the Phase I options.

6) Provide an updated cost estimate for Phase II

7) Conduct an oral presentation of all results to the TPO at METC at the conclusion of Phase I. All reports not previously submitted are due five days prior to the presentation. A comprehensive evaluation of all data presented will be made by DOE and TRW to determine Phase II efforts. Any required changes will be implemented by TRW prior to commencement of Phase II.

b. Phase II - Optional

This phase of work is based upon the Government's acceptance of Phase I and its need to continue the project.

1) Prepare a detailed system design for the selected first field test site.

2) The system design will be based on the requirements and criteria established in the preliminary system design. The detail design for construction will include drawings and specifications for architectural, structural, mechanical, and electrical work

3) Provide an updated cost estimate for Phase III.

c. Phase III - Optional

This phase of work is based upon the Government's acceptance of Phase II and its need to continue the project. The estimated duration of this phase is two years.

1) Initiate the procurement of long-lead items

2) Initiate site preparation and system installation. This shall include obtaining bids, evaluating bids, awarding subcontracts, supervising installation, and participating in acceptance testing

3) Initiate project operations that include system checkout, system operation and maintenance, and data logging

4) Provide for data analysis required to determine technical and economic results

5) Provide for technology transfer to the relevant private sector.

3.4 TRW APPROACH

TRW's goals are to develop and execute, through design and operation of production, collection, conversion and/or utilization (PCCU) systems, various pilot system applications projects for the recovery of methane gases from both active mine areas and virgin coalbeds, and to provide the necessary economic and technical information for implementation of expanded methane recovery operations by industry through suitable technology transfer.

TRW's basic approach for implementing the project is outlined in Figure 3-1. Building upon and updating the existing data base, TRW will identify and evaluate sources for coalbed methane production. By combining the sources with PCCU systems that have been refined with the latest technical and economic data, specific projects will be defined and their demonstration will be planned in detail. Preliminary system designs for site specific projects can then proceed along with requirements and cost-benefit analyses. The results of these activities will permit establishment of criteria for selecting the methane resource contractor(s) with whom agreements on cost-sharing, rights-of-access, etc., can be negotiated. Completion of these Phase I activities would be the initiation point for Phase II. The detailed results of Phase I activities are essential to obtaining specific cost-sharing commitments and site use agreements by participating coal companies. This information will now be available, enabling coal company agreement for implementation of Phase II and III. During Phase II, the

detailed system designs and detailed engineering designs would be prepared, utilizing the data and analyses from the Phase I preliminary systems design as input. These data will be expanded to develop subsystem and system performance specifications suitable for the preparation of detailed engineering drawings and of bid packages for equipment and site subcontractors. Finally, Phase II will include orders for long-lead equipment so as to expedite the demonstration project for the earliest completion. Phase III will be accomplished by evaluating, selecting, and obtaining the requisite subcontractors, preparing the site for each project, installing and checking out the PCCU subsystems, and operating the source/PCCU system for each demonstration project. Technology transfer will be effected throughout all phases by preparation of technical articles, and participation in symposia, workshops, etc., so that the economic and technical data generated by each project can be disseminated to industry for use in initiating methane recovery operations.

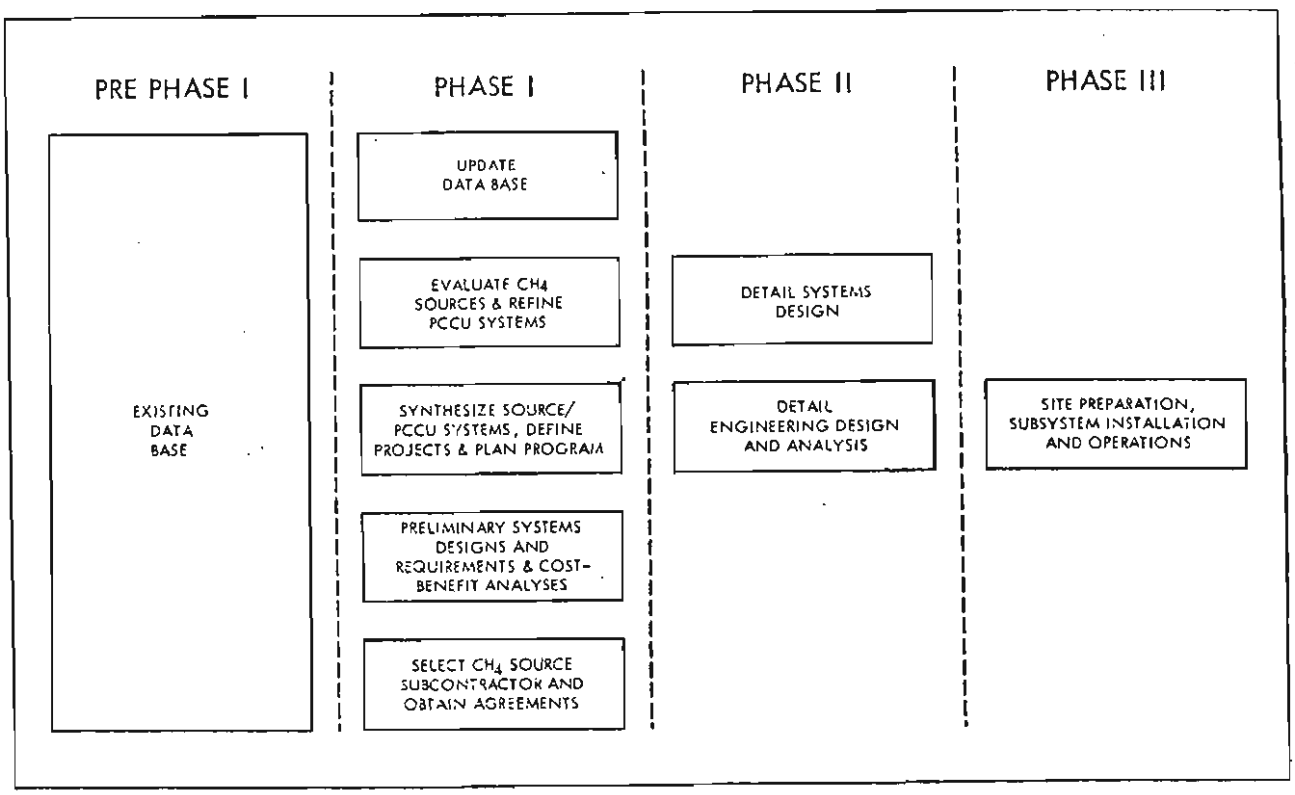


FIGURE 3-1. BASIC PROJECT APPROACH OUTLINE

4.0 PROGRESS DURING JANUARY

4.1 RESOURCE ENGINEERING

Resource Engineering efforts for the month have been concentrated on the completion of testing of a Belco Petroleum well in Sublette County, Wyoming (Green River Basin) and on a Resource Delineation Review meeting.

- Belco Petroleum well, S-29-27, located in Sublette County, Wyoming (Green River Basin) was tested January 2-13, 1979. Data was provided on approximately 13.8 feet of coal ranging from 3435' to 3527' in depth. Preliminary gas shows were good; these indicated Belco to have one of the best gas concentrations in wells tested to date. Desorption is currently in work.

- A Resource Delineation Review meeting was held in Golden, Colorado January 31, 1979. Participants were: D. L. Boreck, D. K. Murray, and C. T. Tremain of the Colorado Geological Survey; M. Gauna, Colorado School of Mines; A. Crawley, DOE/Hq; L. Schrider and R. L. Wise, DOE/Morgantown; M. A. Trevits, DOE/Pittsburgh; R. D. McIver, GeoChem Research; H. Carpenter and H. G. Harris of Harris & Associates; K. Ancell and E. Talone of Intercomp; L. D. Allred and R. L. Coates of Mountain Fuel Supply Company; Dipak Sengupta, SAI/Golden,CO; H. H. Arsonson and E. W. Bond, TRW/Denver; R. Jenkins, A. A. Lee, C. T. Rightmire, and A. D. Starbird of TRW/McLean; T. D. Kurtz, TRW/Morgantown; H. E. Nuttall of the University of New Mexico; Pat Diamond, USBM; and R. V. Huff of Van Poollen & Associates.

  Among the subjects discussed were well test reviews, data format standardization, the Van Poollen review of the Intercomp model, Colorado Geological Survey status, and other DOE projects.

4.2 TECHNOLOGY TEST PROJECTS

The Technology Test Project efforts have been directed primarily at the following areas:

- The Technology Test Project Evaluation Report listing the potential site contractors, their ranking, the criteria used for ranking, and the basis for the selection of four projects as candidates for detailed design phase activities has been completed in draft form. The document will be available for METC review in mid-February.

- Instructions for the development of work breakdown structures and statements of work have been provided to the three contractors for which authorization for detailed design phase activities is expected. The standardized structures and SOW's provide for the separation of the activities by phases and for a measurement of progress and costs.

- A meeting was held with Occidental Research (ORC) representatives to discuss candidate agreements for the expected subcontract with ORC. The proposed cooperative project features the recovery of methane from long-horizontal holes drilled from within the Island Creek Virginia Pocahontas No. 5 Mine at Grundy, Virginia. ORC is currently continuing shakedown tests of the Acker drill with support from the manufacturer.

- The Bethlehem Mines Ellsworth Division is currently rechecking past surveys and is revising ownership and geological maps prepatory to acquiring land for the drilling of a proof well into the main southwest entry.

- Waynesburg College is preparing a revised work statement for the proposed CY 1979 effort to drill and complete a multiple production zone well on the campus. The planned approach is to complete all paperwork so that this activity will proceed as soon as the TRW contract is negotiated and the Waynesburg subcontract is approved.

- TRW participated in a review of the Westinghouse Waltz Mill and Ebensburg projects on January 16 at METC.

4.3 SUPPORT TO METC

Assistance is being provided to METC in preparation of the Semi-Annual Report, the Annual Report, and in pre-Phase I testing of Maurer turbodrill.

- Semi-Annual Report is currently undergoing METC review

- The initial draft of the contract Annual Report was completed. The document will be delivered mid-February.

- Formal, Phase I testing of the flow-through bearing pack turbodrill is scheduled for the week of February 19, 1979. A full set of baseline performance data will be obtained using drilling mud. In addition, two endurance tests will be run at elevated bit-end pressure drops. A complete teardown and determination of wear on internal parts will be made following the tests.

4.3 METC SUPPORT TO HEADQUARTERS

Assistance has been provided to DOE Headquarters when required and requested by METC as a part of their assigned program responsibility. This has included preparation of responses to questions from external sources as they pertain to this project, preparation of inputs to activity planning and program plans related to this project, and preparation of briefing materials when needed.

5.0 WORK PLANNED FOR FEBRUARY

Work planned for February includes:

- Continue to initiate contacts and negotiate cooperative agreements for well sites to be tested during 1979.
- Log and possibly test a Illinois Geological Survey Coal Core hole located in Coles County, Illinois. This will be cored, and the core desorbed by the IGS.
- Publication and distribution of the Resource Delineation Plan.
- Publication and distribution of the Contract Annual Report for CY 1978.
- Assist the three Potential Technology Test Project contractors in the preparation of work breakdowns and statements of work.
- Phase I turbodrill testing at Mission Manufacturing.

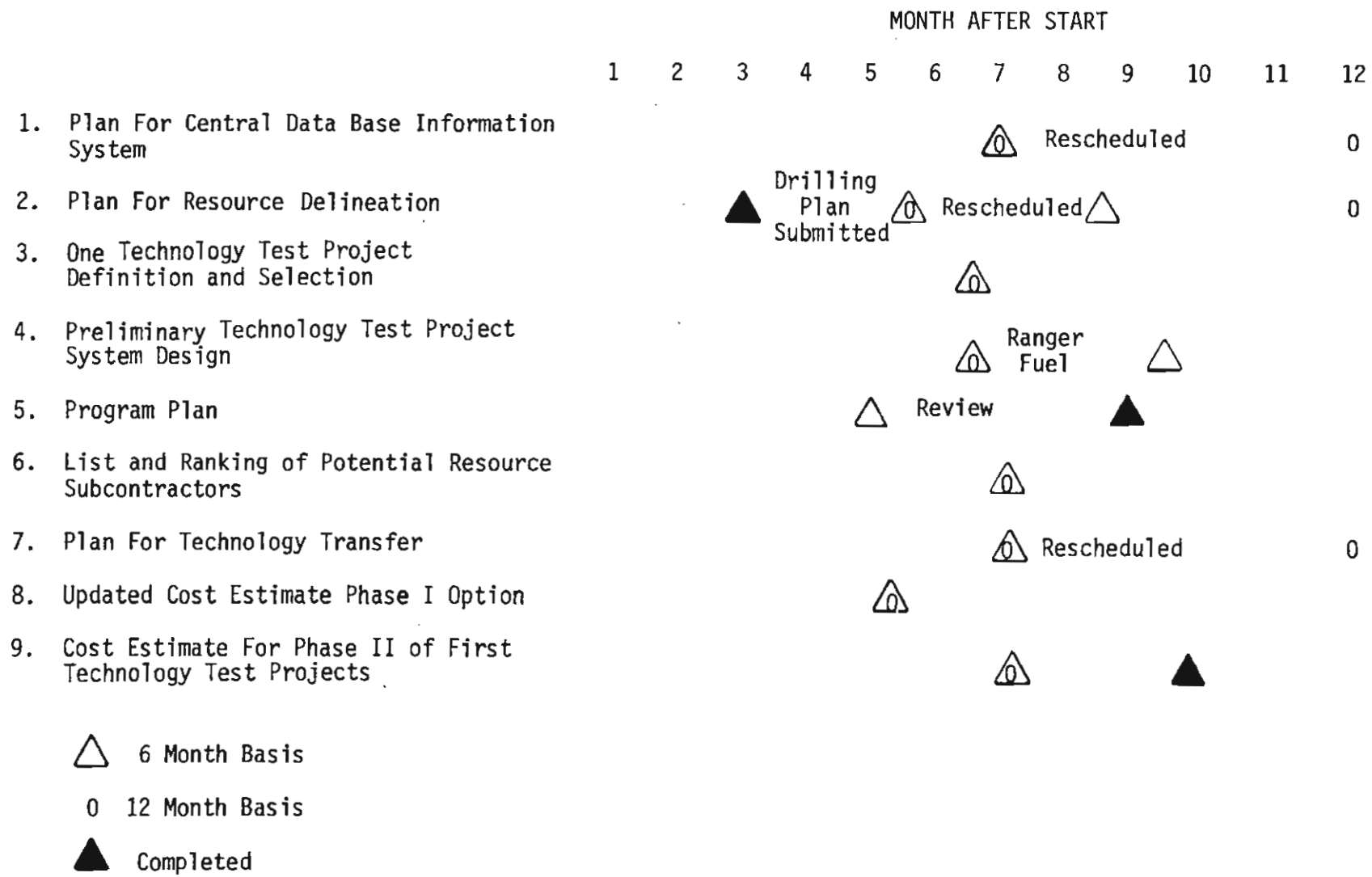
6.0 SCHEDULE

6.1 DELIVERABLE SCHEDULE

The project deliverables are shown in Figure 6-1.

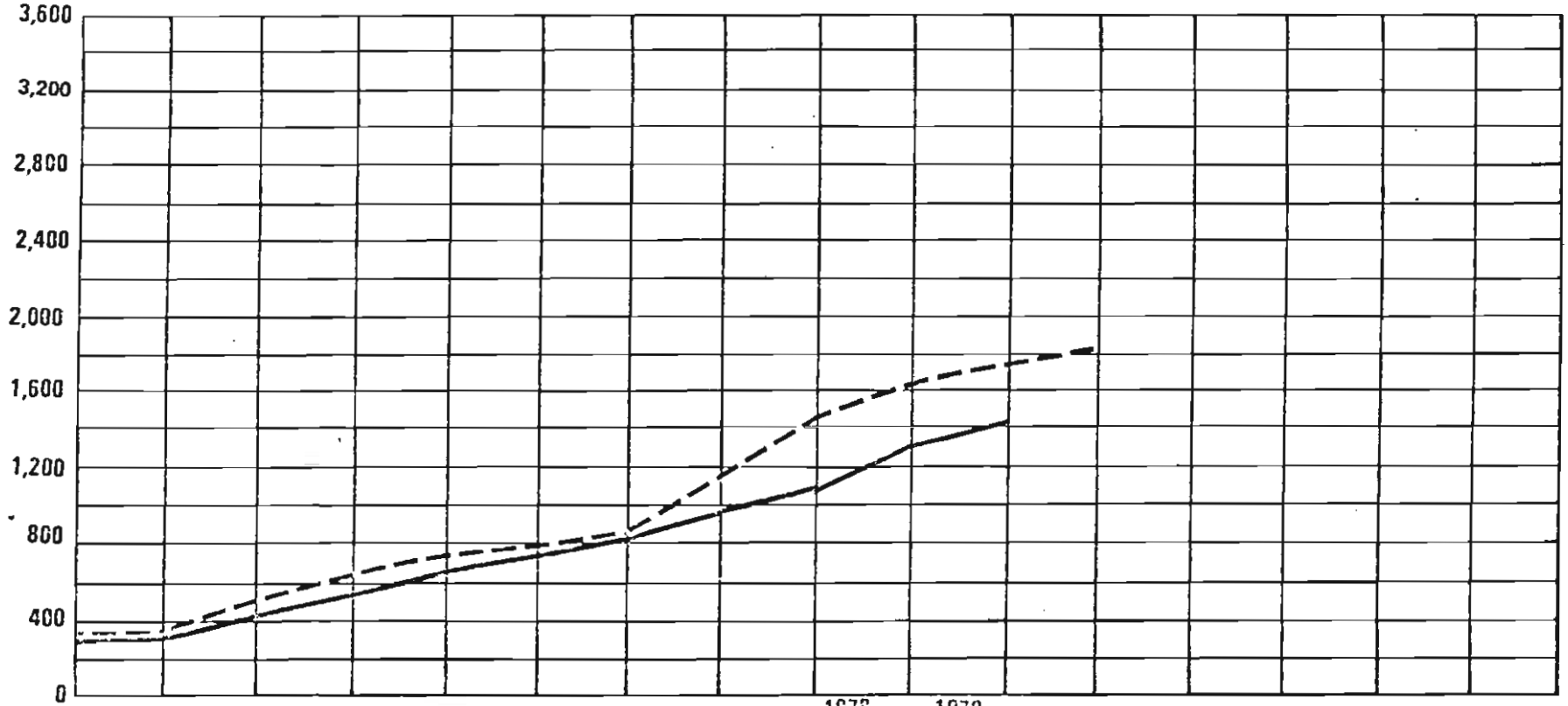
6.2 EXPENDITURE SCHEDULE

Scheduled and actual to-date expenditures are shown in Figure 6-2.


MONTH AFTER START
1 2 3 4 5 6 7 8 9 10 11 12
1. Plan For Central Data Base Information System
Rescheduled
0
2. Plan For Resource Delineation
Drilling Plan Submitted
Rescheduled
0
3. One Technology Test Project Definition and Selection
4. Preliminary Technology Test Project System Design
Ranger Fuel
5. Program Plan
Review
6. List and Ranking of Potential Resource Subcontractors
7. Plan For Technology Transfer
Rescheduled
0
8. Updated Cost Estimate Phase I Option
9. Cost Estimate For Phase II of First Technology Test Projects
6 Month Basis
0 12 Month Basis
Completed

CONTRACT SUMMARY REPORT	CONTRACT TITLE	CUSTOMER	PERIOD ENDING
	Methane from Coalbeds	DOE	1/26/79

SALES NUMBER	CONTRACT NUMBER	CONTRACT TYPE	CONTRACT PERIOD	CONTRACT VALUE ($ 000)			
			FROM: 12/12/77 TO: 2/12/79	COST	FEE	%	TOTAL
97141	EW-78-C-21-8089	CPFF		1815	149	8.2	1964



	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	1978 DEC	1979 JAN	FEB
PLAN	380	508	667	725	782	853	1129	1434	1630	1770	1815
ACTUAL	350	441	547	637	711	823	953	1075	1320	1441	
VARIANCE	30	67	120	88	71	30	176	359	360	329	
COMMIT.	26	47	108	92	127	110	127	251	360	373	

DEVELOPMENTS/PROBLEMS THIS REVIEW PERIOD:
This report reflects cost only.
The actual for the month of January is $121K.

PROJECT MANAGER
A. D. Starbird

OPERATIONS MANAGER
R. L. Robertson

— — — PLAN
——— ACTUAL

Figure 6-2. Expenditure Schedule

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ENERGY

79-1

METHANE RECOVERY FROM COALBEDS

- Collection and Utilization Systems -

MONTHLY PROGRESS REPORT

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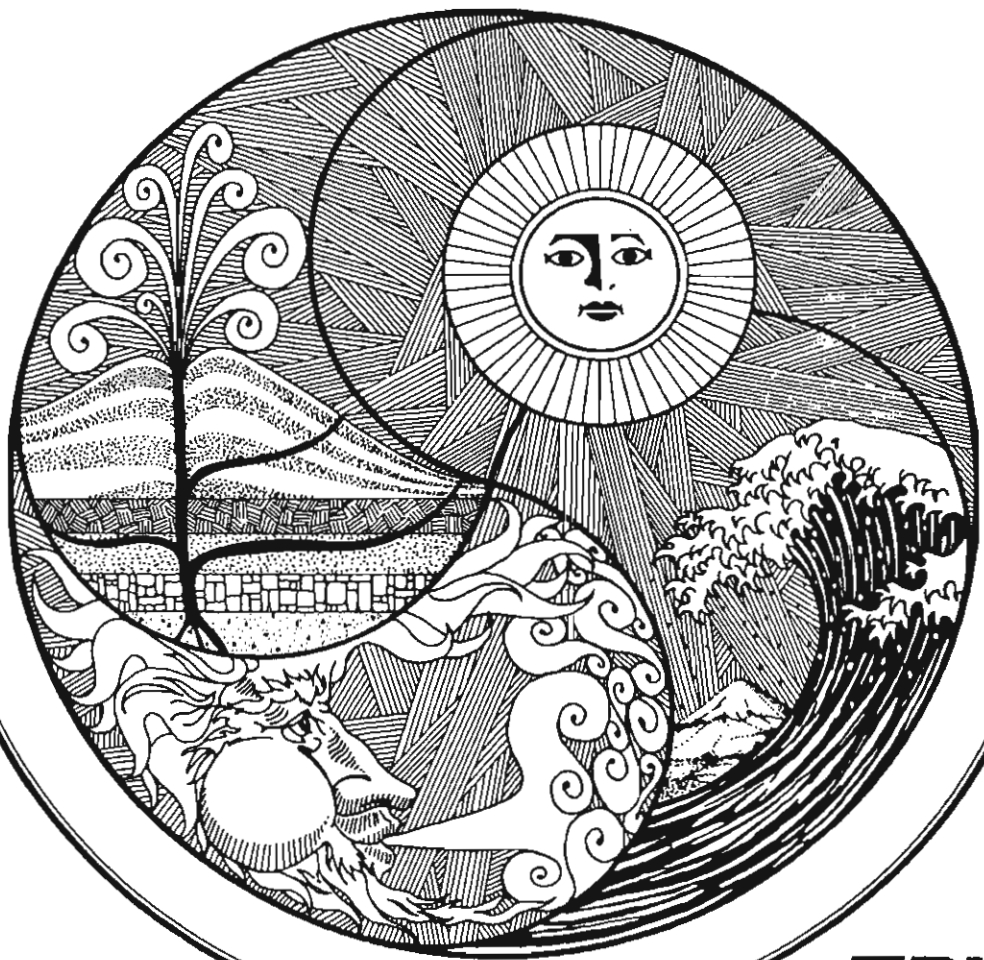

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