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DIVISIONAL REPORT MRL 75-14 RAPPORT DIVISIONNAIRE

APPROVED PROJECTS 1975/76

UNDERGROUND ENERGY DEVELOPMENT PROGRAM - SUPPLY - COAL

by

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CONTENTS

	<u>Page</u>
Introduction	1
Activity 1: Mineability Research Proposals	2
Task 1: Saskatchewan Lignite Reserves Assessment	2
Task 2: Underground Mining Methods	3
Activity 2: Ground Control Research	4
Task 3(a): McIntyre Mines - Pillar Stability	4
Task 3(b): McIntyre Mines - Subsidence	4
Task 4(a): Kaiser Resources - Hydraulic Mine	5
Task 4(b): Kaiser Resources - Subsidence	6
Task 5: Mine Design Documentation	7
Task 6(a): Roof Support - Testing	7
Task 6(b): Roof Support - Research	7
Activity 3: Environmental Control	8
Task 7(a): Spontaneous Combustion (Laboratory)	8
Task 7(b): Spontaneous Combustion (Field)	9
Task 8: Methane/Coal Dust Explosions	10
References	10

LIST OF TABLES

1: Relationship of Activities and Tasks to Departmental Objectives	11
2. Manpower Distribution - Energy Development Program - Supply - Coal	12
3. Budget 1975/76 - Energy Development Program - Supply - Coal	13

Approved Projects 1975/76
Underground Energy Development Program - Supply - Coal

by

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INTRODUCTION

A previous report (1) reviewed the research work carried out in this program during 1974/75 and listed the research activity and task proposals for the year 1975/76. These proposals were in excess of what could be feasibly undertaken with current staff and budget availability, this was done deliberately to allow the relative merits of new proposals to be compared with proposals for continuing work from the points of view of meeting Departmental objectives, relative priorities, availability of the necessary expertise, etc. In January 1975 the managers/coordinators meeting was held in Ottawa at which time these proposals were reviewed and work priorities were decided. This report details the proposals which were approved at that meeting and which are therefore the approved research activities and tasks for the 1975/76 fiscal year.

Work has been approved in the three activity areas of Mineability research, Ground Control research and Environmental Control research. Eight separate tasks have been identified in these three activity areas. Table 1 indicates how each of these three activities and eight tasks relate to the overall Departmental objectives. Specific task objectives are detailed in the task proposals given in this report.

Table 2 summarizes the professional and technician man power requirements for these activities and tasks. Table 3 gives the estimated budget required to carry out this approved work. Total costs are estimated to be \$367,610 of which it is estimated that \$75,000 will be directly contributed by cooperating mining companies, leaving a total 'in house' cost of \$322,610.

The ensuing pages give details of these approved tasks.

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ACTIVITY 1: MINEABILITY RESEARCH PROPOSALS

Task 1: Saskatchewan Lignite Reserves AssessmentTask Leader: J. TomicaObjective

To take GSC data on the lignite resources of Saskatchewan and assess the recoverable tonnage and to estimate the cost of this recovery.

Status and Background

A general approach to this task was outlined in 1973; work was suspended in late 1973 due to staff resignation. Work resumed in 1974 with a new staff member. Task is limited to open pit mining operations to a depth of 150 ft. The system for selecting the draglines and for determining their capital costs is completed.

Expected Benefits

A more realistic assessment of the lignite reserves and their mining costs will provide one element of the complex Government inventory of national energy reserves.

Work Schedule

- | | |
|---|---------------------------|
| 1. Establishment of recovery factor, equipment selection criteria, mining and operating costs (for dragline methods). | June 1975 |
| 2. Establishment of recovery factors, equipment selection criteria, mining and operating costs (for truck and shovel operations). | December 1975 |
| 3. Computer programming of procedures established above (and integration with GSC programs).
[schedule subject to notes below] | June - December 1975 |
| 4. Computer processing of GSC data, production of strip ratio, recoverable tonnage and mining cost contour maps. | October 1975 - April 1976 |

Staff: Professional man days - 200 (JT; KB)

Costs above 'norm': Computer contract work \$30,000
Computer time \$ 5,000

Notes

- (1) No approval was received for the additional engineer requested for this project; hence work schedule has been changed from that given in the original proposal (1).
- (2) Expert assistance from a geo-statistical/computer scientist is essential for this project; it is suggested that this aspect of the work be done under contract and a budget of \$30,000 has been estimated for this. However, to date, no funds have been provided for this. Unless this assistance is received the full potential value of this work will not be realized and the output will fall short of the required objectives. Likewise the schedule calls for this work to start in June 1975; any delay in contracting this work by this time will accordingly change the schedule.

Task 2: Underground Mining MethodsTask Leader: J. TomicaObjective

To derive criteria for assessing the costs of various underground mining methods.

Status and Background

A logical extension of the coal mining inventory of reserves will be to consider the recoverable tonnages of coal and the mining costs of underground mining in (a) the plains coals of Saskatchewan and Alberta and (b) in the foothills and mountain coals of Alberta and B.C. To be able to tackle such problems it will be necessary to review various mining methods and to assess the range of conditions in which they might be applied before a start can be made on the costing and comparison of specific mining methods. During the coming year it is proposed merely to gather some preliminary technical and economic data from existing mining operations in order to better specify future requirements and priorities in this task.

Expected Benefits

Establishment of a costing basis for underground coal mining methods is an essential step in determining the inventory of national energy resources.

Work Schedule

1. Visits to existing underground mines, gathering of preliminary technical and economic data.

Staff: Professional man days - 30(JT)

Costs: normal

Notes

- (1) This task was not included in the original proposals (1); re-scheduling of task 1 has made available approximately 30 man days for this task. Initiation

of this work will depend on task 1 adhering to the outlined schedule; should task 1 overrun its allotted time then this work will not commence in this fiscal year.

ACTIVITY 2: GROUND CONTROL RESEARCH

Task 3(a): McIntyre Mines - Pillar Stability

Task Leader: H.U. Bielenstein

Objectives

To monitor pillar and roadway deformation during pillar extraction and to endeavour to optimize retreat design.

Status and Background

No. 2 mine has been worked on a retreating pillar extraction scheme for over one year. Instrumentation installed last year has now been mined out and data is being analysed. New measurement sites will be installed in accordance with principles based on the interpretation of data collected to date.

Expected Benefits

A more systematic approach to depillaring will yield a higher extraction ratio, by leaving less coal behind. Principles established in this mine should be applicable to other room and pillar coal mines.

Work Schedule

1. Analysis of data accumulated to date; recommendations to McIntyre on extraction patterns. June 1975
2. Installation of new measurement stations (timing will depend on overall retreat patterns in the mine).
3. Interpretation of data from new measurement sites.

Staff: Professional - 90 m.d. (HUB; FG)
Technician - 100 m.d. (SRC; EW; RW)

Task 3(b): McIntyre Mines - Subsidence

Task Leader: H.U. Bielenstein

Objective

To monitor strata deformation in a multi-seam mining situation, where the seams are separated by 400 ft.

Status and Background

During 1974, five subsidence detection holes were installed between the two coal seams, and instrumentation for determining pillar and room deformation was installed in the upper seam. Monitoring will continue during the coming year and additional measurement sites may be installed.

Expected Benefits

This study should yield basic data pertinent to future mine design in this and other areas; it will also act as a warning system for the operator should subsidence occur in the upper seam.

Work Schedule

1. Monitoring of existing instruments and analysis of data. November 1975
2. Additional instrumentation (if and when required).

Staff: Professional - 120 m.d. (HUB; FG)
 Technician - 80 m.d. (EW; RW)

Costs above 'norm' (3a + 3b): \$10,000 - purchase of drill (required also for task 4).
 Equipment, drilling, travel - \$20,000 -
 to be funded by McIntyre Mines Ltd.

Task 4(a): Kaiser Resources - Hydraulic Mine Task Leader: M.Y. Fisekci

Objectives

To investigate strata behaviour as hydraulic mining is carried out at greater depths; to determine the principle zone of movement in the strata as the thick Balmer seam is extracted.

Status and Background

The task was initiated in late 1974, allowing program plans to be made and necessary equipment and supplies to be ordered. Instrument installation commenced in early 1975. Initial plans cover only two underground measurement sites; planning of further installations will depend on success of these first two installations.

Expected Benefits

Hydraulic mining is new to Canadian technology, a better understanding of the strata control problems will help to develop this mining method for application in other areas.

Work Schedule

- | | |
|---|------------------------|
| 1. Installation of roadway convergence, arch load, strata and pillar deformation sites. | May 1975 |
| 2. Monitoring of these sites. | May - October 1975 |
| 3. Allied instrument development. | April - September 1975 |
| 4. Preparation of proposal for continuation/expansion to K.R.L. | September 1975 |

Staff: Professional - 200 m.d. (MYF; DBL)
 Technician - 120 m.d. (SRC; EW; RW)

Task 4(b): Kaiser Resources - Subsidence

Task Leader: M.Y. Fisekci

Objective

To document and monitor surface movements caused by underground hydraulic mining.

Status and Background

Significant surface subsidence has already taken place over the relatively shallow panels mined in the hydraulic mine. Two survey lines were installed over future panels during the fall of 1974 just prior to snowfall; some documentation of observed surface effects has been completed.

Expected Benefits

A better understanding of the caving characteristics of the Kootenay Formation will be invaluable in future mine design.

Work Schedule

- | | |
|--|--------------------------|
| 1. Monitoring of existing survey movements and extension of survey grid. | Continuing through 75/76 |
| 2. Development of all weather displacement recording instrumentation. | By fall 1975 |
| 3. Geologic mapping of Sparwood Ridge with emphasis on structural geology. | Summer 1975 |

Staff: Professional - 80 m.d. (MYF; DBL)
 Technician - 40 m.d. (RW)

Cost above 'norm': \$ 2,000 - computer data processing.
 \$27,500 - equipment, drilling, travel - to be funded by Kaiser Resources.

Task 5: Mine Design DocumentationTask Leader: F. GrantObjective

To gather mine design data on past mining practice as a basis for future mine design.

Status and Background

Future mining in the mountain/foothills belt and in the prairies will have to rely extensively on past experience from viable mining operations. It is proposed to gather data on the geometry, dimensions of openings and pillars, support systems and mining methods of past operations.

Expected Benefits

The establishment of a knowledge bank so that the impact of new technology in similar conditions may be better assessed.

Work Schedule

1. Visits to mines and inspectors offices to gather data. As convenient during the year.

Staff: Professional - 30 m.d. (FG)

Costs: Normal

Task 6(a): Roof Support - TestingTask Leader: F. Grant

This service to mining companies has proven to be valuable to the mines and invaluable to our working relationship with the mines. Service work will be carried out where and when requested, within the limits of the time allotted.

Staff: Professional - 30 m.d. (FG)
Technician - 40 m.d. (EW; SRC)

Costs: Normal

Task 6(b): Roof Support - ResearchTask Leader: F. GrantObjective

To improve roof support in coal mines by evaluating the effectiveness of support innovations such as resin bolts, roof trusses, etc.

Status and Background

Improvement of roof support systems is a continuing process requiring comparative studies between different systems under a variety of conditions. At present no specific sites have been chosen, but possible mines include McIntyre, Canmore, or one of the Prairie mines. The current atmosphere is favourable for a serious research approach to roof support studies and it is believed that a suitable site can be arranged during the winter of 1975 for testing in the summer of 1975.

Expected Benefits

Effective roof support systems can make a great difference to mining costs, maintenance costs and safety.

Work Schedule

To be decided.

Staff: Professional - 80 m.d. (FG; KB)
Technician - 100 m.d. (SRC; EW)

Costs: Normal (should be cooperative project with company concerned).

ACTIVITY 3: ENVIRONMENTAL CONTROL

Task 7(a): Spontaneous Combustion (Laboratory)

Task Leader: K.K. Feng

Objectives

To study the nature of gaseous products during the early stages of spontaneous combustion for Balmer seam coal; to establish the variation in liability for spontaneous combustion within Balmer seam coal; to study the conditions under which CO is formed from coal.

Status and Background

It is believed that the risk of spontaneous combustion is a function of both the spontaneous combustion liability of the coal and the surrounding mine environment. This part of the task is aimed at establishing the parameters influencing the liability of Balmer seam coal to spontaneous combustion and the gaseous products resulting from combustion.

Expected Benefits

Knowledge of the gaseous products involved can give good leads to the development of early detection systems; knowledge of the variability within the coal seam may indicate areas in which the field studies should be concentrated.

Work Schedule

Sample testing throughout the year.

Staff: Professional - 85 m.d. (KKF; RNC)
Technician - 100 m.d. (Ottawa)

Costs: Normal

Task 7(b): Spontaneous Combustion (Field)

Task Leader: R.N. Chakravorty

Objectives

To install, test and calibrate a continuous CO monitoring system in K.R.L. hydraulic mine; to develop infra red technology as a complimentary field indication system for spontaneous combustion.

Status and Background

Currently Kaiser Resources Ltd. is the only Western Canadian coal mine to suffer from spontaneous combustion problems. Spot sampling of mine air for CO content has proved to be inadequate for detection purposes; a continuous monitoring system should therefore be tried. Preliminary work has indicated that infra red technology may prove to be a good means of detecting heating at early stages.

Expected Benefits

A clear understanding of the mining conditions and/or the coal liability can help towards the controlling of this mine hazard; likewise early detection can prevent major disruption of mining operations and can improve safety and recovery.

Work Schedule

- | | |
|--|------------------------|
| 1. Delivery of analytical and recording hardware. | August 1975 |
| 2. Installation. | September/October 1975 |
| 3. Calibration and testing. | October/November 1975 |
| 4. Ventilation and pressure surveys, air leakage surveys, infra red temperature surveys. | Throughout the year |

Staff: Professional - 175 m.d. (RNC; KKF)
Technician - 140 m.d. (SRC; RW; EW)

Costs above 'norm': \$27,500 - monitoring system and travel - to be funded by Kaiser Resources Ltd.
\$ 9,300 - additional equipment for air velocity, ventilation pressure, methane surveys and for infra red scanner.

Task 8: Methane/Coal Dust ExplosionsTask Leader: K.K. FengObjective

To conduct a literature survey on the causes and prevention of methane/coal dust explosions.

Status and Background

In the mountain areas of Western Canada coal mining conditions pass quickly from shallow to deep. The hazard of methane/coal dust explosions will predominate in deep gaseous coal mines. The overall objective is to study the causes of such explosions and the means of preventing them. This would also include the detection and quenching of ignitions of gas at the face during mining, and the prevention of explosion propagation by such dust barriers.

Expected Benefits

Improved mine safety.

Work Schedule

Start of art report on methane/coal dust explosions and identification of research needs.

August 1975

Staff: Professional - 20 m.d. (KKF)

Costs: Normal

REFERENCES

1. H.U. Bielenstein, "Project Reviews 1974/75 and Proposals 1975/76. Underground Energy Development Program", Mines Branch Internal Report 74/140, December 1974.

TABLE 1

Relationship of Activities and Tasks to Departmental Objectives

Departmental Objectives			Underground Energy Development Program Supply - Coal	
Objectives	Sub-Objectives	Sub-Sub-Objectives	Activity	Task
1. Ascertain resource potential	1.1 Resource potential; identify mineral deposits of potential economic interest	1.1.1 Assess fossil fuel resources	<u>A.1 Mineability</u>	T.1 Saskatchewan Lignite Reserves assessment and costing
				T.2 Underground mining methods
2. Improve the means of discovery, mining, processing, transportation, and use of the mineral and energy resources available to Canada	2.1 Mining; develop mining (excavation) technology that is important for exploiting Canadian resources	2.1.1 Advance new technology in mining and other excavating operations	<u>A.2 Ground Control Research</u>	T.3 McIntyre Mines Ground Control (a) Pillar stability (b) Subsidence
				T.4 Kaiser Resources Ground Control (a) Hydraulic Mine (b) Subsidence
				T.5 Mine Design Documentation
		2.1.2 Improve working conditions in mines	<u>A.3 Environmental Control</u>	T.6 Roof Support (a) Testing (Service) (b) Research
				T.7 Spontaneous Combustion (a) Laboratory (b) Field
				T.8 Methane/Coal Dust Explosions

TABLE 2

Manpower Distribution - Energy Development Program - Supply - Coal

Item				Professional Man Days								Technician Man Days					
Activity	Task	Sub-Task	Dept. Objectives	KB	HUB	RNC	MYF	FG	DBL	JT	KKF	Total	SRC	EW	RW	OTT	Total
A.1 Mineability	T.1 Saskatchewan Lignite Reserves Assessment		1.1.1	50						150		200					0
	T.2 Underground Mining Methods		1.1.1							30		30					0
A.2 Ground Control	T.3 McIntyre Mines	(a) Pillar stabil stability	2.1.1		60			30				90	50	30	20		100
		(b) Subsidence	2.1.1		100			20				120		60	20		80
	T.4 Kaiser Resources	(a) Hydraulic mine	2.1.1				140		60			200	60	10	50		120
		(b) Subsidence	2.1.1				40		40			80			40		40
	T.5 Mine Design Documentation		2.1.1					30				30					0
	T.6 Roof Support	(a) Testing (Service)	2.1.2					30				30	20	20			40
(b) Research		2.1.2		10			70				80	30	70			100	
A.3 Environmental Control	T.7 Spontaneous Combustion	(a) Laboratory	2.1.2			10					75	85				100	100
		(b) Field	2.1.2			170					5	175	40	20	80		140
	T.8 Methane/Coal Dust Explosions		2.1.2								20	20					0
Research Administration				40	20	15	15	15	0	15	0	120					
Total - Research Activities I				100	180	195	195	195	100	195	100	1260	200	210	210	100	720
Office Administration				10	10							20	20	10	10		40
Consultations				15	15	15	15	15	0	15	0	90					0
Other				(1) 95	15	10	10	10	0	10	0	150					0
Total - Non Research II				(1) 120	40	25	25	25	0	25	0	260	20	10	10		40
Overall Totals (I + II)				(1) 220	220	220	220	220	(2) 100	220	(3) 100	1520	220	220	220	(3) 100	760

(1) Includes 80 man days allotted to management training.

(2) Postdoctorate Fellowship terminates Sept. '75.

(3) Remaining time accountable to CERL.

TABLE 3

Budget 1975/76 - Energy Development Program - Supply - Coal

Activity	Task	Prof. Man Days	Prof. ① Man Years	Normal Costs at ② \$40,000/prof. m.y.	Costs in Excess of Normal - \$				Notes	Total \$
					Equip., M & S	Drilling	Travel	Computer		
A.1 Mineability	T.1 Sask. Lignite Reserves Assessment	200	0.909	36,360	-	-	-	5,000	Computer time	71,360
								30,000	Contracting of computer services ③	
	T.2 Underground Mining Methods	30	0.136	5,440	-	-	-	-		5,440
A.2 Ground Control	T.3 McIntyre Mines Ground Control	210	0.954	38,160	10,000				Purchase of drill (also for use in Task 4)	68,160
					5,000					
				10,000						
							5,000			
	T.4 Kaiser Resources Ground Control	280	1.273	50,910	15,000				} Extra costs to be paid for by Kaiser Resources Ltd.	80,410
					10,000					
							2,500			
								2,000	Data processing	
	T.5 Mine Design Documentation	30	0.136	5,440						5,440
	T.6 Roof Support	110	0.50	20,000						20,000
A.3 Environmental Control	T.7 Spontaneous Combustion	260	1.182	47,280	25,000				} Purchasing of CO monitoring equipment. Extra costs paid by Kaiser Resources Ltd.	84,080
								2,500		
					9,300				Purchase of infra-red scanner, etc.	
	T.8 Methane/Coal Dust Explosions	20	0.091	3,640						3,640
Research Administration		120	0.545	21,800						21,800
Office Administration, Consultations, etc.		260	1.182	47,280						47,280
Totals		1520	6.908	276,310	64,300	20,000	10,000	27,000		407,610
Funds estimated from external sources (20,000 McIntyre + 55,000 Kaiser)										75,000
Total "in house" costs										332,610

① 220 man days/prof. man year (52 x 5 - 12 public holidays - 15 days leave - 3 sick leave = 220).

② \$40,000/prof. man year includes all technicians, administrative support plus \$1000/prof. man year 'normal' travel + \$2000/prof. man year 'normal' equipment, materials and supplies.

③ This item not yet finalized; see note on detailed project proposal.

