Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

CANMET
Canada Centre for Mineral and Energy Technology
Centre canadien de la technologie des minéraux et de l'énergie

NACMMR ENERGY SUPPLY SUB-COMMITTEE REPORT FOR 1979

by

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February 1980

CANMET ENERGY RESEARCH PROGRAM

REPORT ERP 80-4 (TR)

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SUMMARY

NACMMR's (National Advisory Committee for Mining and Metallurgical Research) bi-annual review of CANMET's energy supply R & D was held in October 1979. A sub-committee of 16 senior executives from industry and provincial government in a two-day meeting studied current and planned work, discussed details with CANMET staff, and made recommendations for the future.

CANMET's energy supply R & D includes oil sands mining and uranium reserve assessment, but this review concentrated largely on coal, from reserve assessment through mining to preparation. Oil sands mining was considered only briefly and uranium assessment not at all. (Oil sands, heavy oil, uranium and coal processing and utilization R & D fall into other CANMET sub-programs and have been separately reviewed by NACMMR.)

General recommendations are concerned with the expected massive increase in coal production and use, reflecting its importance as a major indigenous energy source, and particularly with the disproportionately low level of R & D effort towards coal production in Canada. A major increase in federal funding of coal R & D is necessary; current federal spending of $3 million per year is but a small fraction of direct federal revenues from coal production, and should be at least tripled by 1985. Coal directly contributes to solving two of Canada's most pressing problems: balance-of-payments (coal exports are currently worth $500 million annually); and energy self-sufficiency. Often coal can substitute for oil as a fuel, and be converted into liquids or gases. Recent events worldwide, and particularly in the Middle East, have emphasized the vulnerability of North America generally to an interruption of oil supplies. Expanded use of coal would place Canada in a much more secure energy supply position.

R & D is needed in mining technology. CANMET is doing valuable work in specific aspects of mining, but in the long term a broader study of which mining systems are most appropriate in different regions of Canada will be invaluable to the coal industry. Coal transportation R & D must be emphasized, because high freight costs, aggravated by such technical difficulties as spontaneous combustion and handling frozen coal, are the biggest single factor inhibiting increased export and domestic use of Canadian coal. Preparation techniques should be developed to give the highest value product for rail transport, and such alternatives as pipelining

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must be encouraged. More coal-related R & D is needed in the Maritimes. Coal's immediate potential in contributing to energy self-sufficiency is greatest in the Maritimes, but the difficulties of production - largely from undersea mines - and of removing sulphur before use are significant.

Cooperation between R & D agencies in Canada must be fostered. In particular, the Alberta-based Coal Mining Research Centre (CMRC) and CANMET must continue in their existing harmonious relationships, and prevent duplicating work or facilities. Increased R & D effort will require additional skilled personnel. The availability of trained researchers must be ensured.

NACMMR's own contribution to CANMET's efforts would be enhanced by replacing the current energy sub-committees - supply, processing and utilization - by one each for coal, oil sands/heavy oils, and nuclear energy. The new sub-committees would consider all aspects of their commodities, from resource assessment through to end use. Better use of members' talents and time would result from this change. Contracting-out procedures should be streamlined. Contract R & D is a useful mechanism, currently hindered by the bureaucracy involved. Streamlined procedures are needed, particularly when the contractor is not benefiting financially, as is often the case in CANMET's cost-shared contracts.

Specific recommendations are made by project. CANMET's existing energy supply projects are largely endorsed, but such safety-related projects as fire and explosion R & D are emphasized in importance, and coal resource/reserve assessment, though nationally significant, is not rated as having a high demand on CANMET's R & D capabilities. Five new projects are recommended:

- In situ Gasification Studies for off-shore Nova Scotia coal that cannot be mined;
- Ash and Moisture Reduction in low-rank coals to improve marketability;
- Dust Control in Coal Mines, because increased production will necessitate greater control of the working environment;
- Improved Geophysical Logging for coal quality determination to maximize data obtained from Canada's extensive exploration drilling;
- Mining Technology, to identify and begin demonstrating mining techniques most appropriate for Canada.

INTRODUCTION

NACCMR's energy supply sub-committee reviews every second year appropriate aspects of CANMET's energy program. These include coal reserve assessment, coal mining, coal preparation, oil sands mining, and uranium reserve assessment. Both R & D and "service" work, for example, certifying underground coal mining equipment, is included.

In 1979 the sub-committee decided to limit its review to supply aspects of coal and oil sands, omitting uranium reserve assessment. The rationale is that CANMET's uranium reserve assessment is largely routine, in support of such mandatory federal activities as licensing uranium mining operations. Changes in this function were unlikely to be recommended by the subcommittee, and expanding the committee to include members with suitable background in nuclear energy was judged to be inefficient.

The sub-committee met for two days in October; its make-up, procedure, and a summary of the discussions are given in appendices A, B and C to this report. Sub-committee recommendations, which are given to the main NACMMR committee and hence relayed to the Minister of Energy, Mines and Resources, form the main part of this report. They are in two parts: General Recommendations, which deal with broad matters such as NACMMR itself, policy, funding, and R & D that would have major effect on Canada's energy supply; and Specific Recommendations, which deal with projects the sub-committee wishes CANMET to include in its energy program.

The main input to the supply sub-committee was a set of briefing notes prepared by the Energy Program Office of CANMET. These notes detailed the current supply projects in CANMET, and also provided background both to these, to the organization and function of CANMET within Energy, Mines and Resources, and to the role of the NACMMR sub-committees. They are not appended to this report, but can be obtained from the Energy Program Office in CANMET (Report ERP 79-8).

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GENERAL RECOMMENDATIONS

1. Substantially increased funding in Canada is required for research and development in coal supply.

Coal is presently both an important energy source and an important revenue earner for Canada. It directly contributes to the two major government objectives of energy self-sufficiency, and reducing inflation (by decreasing imbalance of payments and thus lessening pressures for high interest rates). Coal's scope for increasing its contribution to each of these objectives is immense, but this can only be realized by concerted efforts to expand production and increase efficiency. R & D has a clear role in this. Current direct federal expenditures on coal supply R & D are around $3 million per year. The value of coal production in Canada is in the order of $750 million annually; direct federal tax revenue from coal producers in 1976 - a poor year - was $30 million. Any increase in R & D expenditure, apart from aiding coal's contribution to national well-being, would probably generate additional tax revenue greater than its cost. Apart from R & D, the federal government has specific roles which are vital to coal mining in Canada, and which must also be expanded if increased coal production is not to be hindered. (A prime example is certification of underground coal mining equipment, which is entirely performed by CANMET on behalf of the provinces.) Increased certification capabilities will undoubtedly be required in the near future. This sub-committee recommends a minimum threefold increase in coal mining R and D by 1985.

2. R & D into mining technology should begin at CANMET now.

Current effort in mining methods at CANMET largely deals with specific areas, e.g., ground control aspects of hydraulic mining. Long term benefits in the coming expansion of mining will accrue from determining which mining systems are most applicable in Canadian conditions, particularly in those conditions which are unique to Canada and which involve large resources of coal. Examples include hydraulic mining in various mountain conditions, and longwall mining of steep seams. State-of-the-art reviews on a broad basis would be an appropriate starting point.

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3. R & D into coal transportation should be increased.

The single biggest factor inhibiting increased coal exports and increased domestic consumption of Canadian coals is the exorbitant cost of transport. While freight rates themselves are outside the purview of this sub-committee, R & D has a role to play, first, in achieving a higher value product for shipping (i.e., lower ash, higher calorific value coal), and, second, in solving such problems as spontaneous combustion and freezing in cars. Pipeline transport offers good prospects for short to medium range movement of coal at low cost, and R & D would encourage this.

4. Federally aided R & D into Maritime coal mining should be considered.

Little if any R & D is now devoted to Maritime coal mining, particularly to underground offshore mining which now accounts for about 60% of Canada's underground coal production. There are many challenges facing the researcher, particularly in view of planned expansion. Added emphasis to R & D is given by the relative importance of local coal production to Maritime energy supply. Establishing a research team in the Maritimes is one possibility for CANMET; however, as with all applied R & D, a prerequisite is appropriate cooperation by the coal industry - effectively Devco - and by provincial authorities. This could best be manifested by substantial cost contributions to R & D.

5. Cooperation between CANMET and other research agencies - particularly the Coal Mining Research Centre - is essential.

The sub-committee considers that increased R & D in coal supply is essential. This means there is room for more than one agency concerned with R & D - indeed, this should be encouraged - but it also means these agencies must fully cooperate and avoid duplication of effort in order to maximize returns from the resources available. In the case of CMRC and CANMET, the areas where each is principally involved should be defined; in many cases both can contribute to the same project but in each case a lead agency must be established. In mining it appears that at present CMRC is best suited to operations-related studies, while CANMET could concentrate on mining R & D, e.g., ground control and explosion and fire safety. In coal preparation, there appears a danger of duplication of

effort in constructing pilot plants. CANMET currently operates a versatile 10-ton-per-hour coal preparation pilot plant in Edmonton. This, together with the privately-operated test washing facility in Calgary, and CANMET facilities in Ottawa, ought to be more than adequate for the needs of the Canadian coal industry. Were a second pilot plant to be built, it should be located in Eastern Canada. When CMRC does develop coal preparation research, the advantages of combining their efforts with existing facilities should be considered. CMRC facilities should complement CANMET's, or arrangements should be made for joint use of one pilot plant, e.g., with CMRC contributing funds, staff, or equipment. This sub-committee cannot emphasize too strongly the need to avoid duplication of effort, particularly between CMRC and CANMET. Specific R & D activities in which there is particular danger of duplication include: dust control in coal mines; moisture and ash content of sub-bituminous coal; coal mining technology; coal preparation; and geophysical logging of coal.

6. The make-up of NACMMR's sub-committees should be reviewed.

In the energy program of CANMET three "commodities" are included: coal; non-conventional oil; and nuclear fuel. It appears probable that three sub-committees, each reviewing all energy-related research and development in one commodity, would function more efficiently. Senior industry representatives usually have extensive knowledge of all aspects of one commodity, but little detailed knowledge of another. For example, a senior coal executive would be keenly interested in, and aware of, requirements in coal R & D from reserve assessment through to coal combustion. He probably has little knowledge of oil sands processing. An oil sands/heavy oil sub-committee could deal with mining and processing, with input from all members (suggested terms of reference for an oil sands sub-committee are given in Appendix D). Similarly, a nuclear fuel sub-committee could cover reserve assessment, mining, extraction, and waste disposal. It is recognized that aspects of nuclear fuel R & D occur in the minerals program, and also that the commodity approach would not be applicable to the minerals program sub-committees.

7. The availability of trained R & D personnel should be investigated.

The recommended expansion in R & D will require a significant increase in R & D personnel. Resources should be allocated to developing the necessary skilled researchers. Contracting out is encouraged as a means of overcoming this problem, at least partially.

8. Contracting-out procedures should be improved.

Make-or-buy, the federal government's policy of contracting out R & D and thereby fostering R & D capability in industry, is recognized by the sub-committee as a valuable technique, provided proper expertise remains in government laboratories. However, CANMET's R & D performance - and undoubtedly that of other government agencies - is particularly hindered in cost-shared contracts by the complex and cumbersome procedures involved. Senior industry staff are often involved in tedious negotiation that is frequently not merited. This has discouraged some companies - especially large companies such as coal producers, for whom the funds involved are small - from participating in such joint ventures. A simpler procedure for awarding contracts, particularly where the contractor is not profiting financially, should be evolved. This recommendation is particularly important because cost-shared contracts are normally those in which industry participates, and these are therefore among the most important in energy supply R & D.

SPECIFIC RECOMMENDATIONS

These recommendations are in the form of outline projects, which CANMET at this time, in the view of the sub-committee, should undertake. They include existing CANMET projects, revised where appropriate, and new projects. In drafting these projects, the sub-committee has been mindful of the resources presently available, and has ensured the total suggested resources are not grossly different. However, this does not detract from the general recommendation that substantially increased funding is needed. It does reflect the realistic acceptance that resources are unlikely to be massively increased in the near future. All these projects could - and should - be greatly increased in scope were resources to be available.

On the following page the recommended projects, with current and recommended resources, are tabulated. A relative priority is also given; the scale is arbitrary, with 100 indicating the project is essential now to the national interest, and 10 indicating an unimportant project. Existing projects are given the same number as in the briefing notes distributed to the sub-committee (available from CANMET's Energy Research Program Office, Report ERP 79-8). New projects which the sub-committee is recommending be commenced are identified as such.

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Project	Recommended effort PY	Salaries $000	Operating $000	Contracts $000	Total	Relative Value	Present effort PY	Salaries $000	Operating $000	Contracts $000	Total $000
Quality of coal resources	10	400	60	-	460	60	10	400	61	-	461
Quantity of coal reserves	4	160	22	-	182	60	4	160	22	-	182
Oil sands mining	1	40	5	50	95	60	0.5	20	10	50	80
Ground control	6	240	80	150	470	90	7	280	80	100	460
Fire and explosion safety	10	400	150	250	800	100	10	400	120	40	560
Coal prep. pilot plant	4	160	120	-	280	80	3	120	35	-	155
Coal prep. processes	10	400	75	60	535	80	10	400	75	60	535
Water effluent	1.5	60	22	75	157	80	1.5	60	22	175	257
Chacterizing coal	1.5	60	30	35	125	80	1.5	60	30	35	125
Mobile pilot plant	1	40	21	-	61	35	1.5	60	21	-	81
Coal slurry transport	4	160	50	50	260	80	2	120	21	-	141
Ash and moisture reduction	2	80	20	200	300	80	- NEW PROJECT -				
In situ gasification	-	-	-	80	80	60	- NEW PROJECT -				
Dust control in coal mines	2	80	50	30	160	100	- NEW PROJECT -				
Mining technology	1	40	10	250	300	70	- NEW PROJECT -				
Geophysical logging	-	-	-	70	70	50	- NEW PROJECT -				
Totals	58	2320	715	1300	4335		51	2080	487	105	3037

Project 312101 - Quality of Coal Resources

Objectives

a) to systematically analyze selected Canadian coals to determine coal characteristics for a national coal inventory and provincial inventories;

b) to provide internationally recognized analytical facilities for Canadian industry, and to maintain analytical standardization services.

c) to perform research on the development and application of analytical methods and techniques as they relate to the uniqueness of Canadian coals.

Relevance

It is essential to develop a national coal inventory for formulation of a national energy policy, for industrial planning, and for provincial energy policies and regional development. The inventory will be of value to industry in establishing its competitive position nationally and internationally.

Time Frame

The national inventory is of immediate importance and should be prepared on a "best effort" basis with data available now.

At five years, all potential producers to 1995 should be inventoried.

At ten years the inventory should be in the "annual update" stage.

Specific Work

1. A project to investigate why coking characteristics of western Canadian coals cannot be predicted on the basis of western European or Japanese testing techniques. This research may lead to the development of new techniques of evaluation or the identification of parameters of unique value to Canadian coals, and establish the suitability of these coals to a broader market.

2. The emphasis on analysis at CANMET should be on the total sample. When beneficiated samples are received, representative portions of the rejected material shall also be examined and the analytical program should characterize fully all of the parameters bearing on reasonably foreseeable uses. The service aspect of the CANMET laboratories would be deemphasized; the provenance and history of all samples should be documented. Analyzed coals should include all coals, not just those currently

deemed to be commercial.

3. Screening of current data held by CANMET should begin immediately to retrieve those data which would be of use in the inventory.
4. The objectives of the laboratory and technical support under the DREE-Nova Scotia resource inventory should be brought into line with those outlined above.

Relative Value

60.

Minimum Resources

Present allocation of 10 person years appears adequate.

General

Projects 312101 and 312102 are concerned with establishing a national coal inventory for Canadian coal resources and reserves. Ideally, this would include coal quality, mineability, and such data as carbonization characteristics. It would also be useful to distinguish coals suitable for upgrading by preparation into a product suitable for long distance transportation, and those best suited only for use near the mine. In practice, it is recognized that it would be difficult to achieve an inventory of this sophistication. Instead, a "best available data" approach should be followed with reliance heavily on existing provincial inventories.

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Project 312102 - Inventory of Canadian Coal

Objective

To prepare an annual estimate of Canada's coal resources by rank, level of assurance, proximity of infrastructure, geological complexity, and environmental sensitivity.

Relevance

An integral part of a national coal inventory (see project 312101).

Time Frame

As for Project 312101.

Specific Work

CANMET to act as coordinating agency for establishing procedures and definitions through meetings with, e.g. provincial agencies and representatives of industry. Resource data should be collected and supplied by provincial agencies unless the federal government is requested by the provinces to assist in compiling data.

Relative Value

60, because of the significance to formulating a coherent national coal policy.

Minimum Resources

Present resources of 3.7 person years appear adequate.

General

Responsibility for a national coal inventory rests with the federal government. However, input is primarily from provincial authorities responsible for assessing coal resources and reserves within a particular province.

The CANMET coordinating team should be centered in Calgary.

Project 333101 - Oil Sands Mining

Objective

To participate actively in R & D by others, notably AOSTRA, and thereby maintain full awareness of technology developments in oil sands and heavy oil recovery.

Relevance

The oil sands have such importance, and federal involvement in financing directly or in product price support is sufficiently great, that federal interests can only be properly supported by active involvement, and the awareness this brings.

Time Frame

On-going.

Specific Work

Active involvement in research projects, for example by seconding staff to AOSTRA or others to participate in R & D.

Attendance at oil sands conferences and seminars by technical staff.

Prepare state-of-art reviews when timely, directed towards long-term technological requirements, but with emphasis also on current technological and environmental problems.

Relative Value

60.

Minimum Resources

A minimum of one person per year full time.

General

Oil sands production is recognized as being very significant to Canada's energy production, and mining - both presently on surface, and in future for underground access - is an essential aspect. The CANMET view, that resources available to AOSTRA for oil sands research appear adequate, is accepted by the sub-committee, although there is a case for allocating sub-

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stantial resources to research into improving present oil sands mining practices. The federal government should be actively maintaining awareness in oil sands mining at the working level, and also should directly contribute to technology development at the working level where it has appropriate expertise.

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Project 334101 - Ground Control in Coal Mining

Objective

To develop improved techniques for predicting and, when necessary, controlling the effects of underground mountain and submarine coal mining on surrounding strata. In particular, to prepare guidelines on ground control for the four main mining methods (hydraulic, room and pillar, longwall and shortwall) considered for Canadian conditions.

Time Frame

On-going - specific tasks to have five year objectives and cut-offs.

Specific Work

Areas of concern are:

1. ground control and pillar size in submarine mines;
2. ground control in multi-seam submarine longwall mining systems;
3. ground control and subsidence in mountain coal mines, specifically hydraulic, room and pillar, longwall, and shortwall mining methods;
4. ground control for fundamental mine design for longwall systems in flat seams in relatively weak strata on the plains;
5. subsidence at the surface affecting agricultural land on the plains.

Relative Value

90, being recognized as most important for safety and economic reasons as well as for resource conservation.

Minimum Resources

Six persons per year full-time.

General

No other group can make resources available on a continuing long-term basis. This emphasizes the importance of the federal government's participation in such work, and also makes it important to liaise with ground control groups in other coal-producing countries. Consultants could be employed in limited areas of field work, and industry would supply help at the technician level. The use of consultants and industry support would be in addition to the six person years recommended above.

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Project 334102 - Coal Mining Explosion and Fire Safety R & D

Objective

To develop: a) improved control of explosion and fire hazards in coal mining; and b) to certify fire-resistant and explosion-proof equipment for underground coal mining including preparation of relevant national standards.

Time Frame

On-going.

Specific Work

1. Develop methods for early detection and where possible control of spontaneous combustion in coal mines.
2. Assess the risk of methane/coal-dust explosions at various Canadian underground mines.
3. Develop methane control technology appropriate to modern coal-mining methods.
4. On-going cost recovery-based work of equipment testing and certification to acceptable national standards.
5. Evaluate factors affecting the safety of coal mining flameproof equipment and fire-resistant materials, and recommend appropriate improvements in equipment materials codes and standards.
6. Evaluate the hazards and recommend remedial measures regarding mine air dust control. (Note that the Coal Mining Research Centre health and safety division, when developed, intends to work in the area of mine dust control.)

Relative Value

100, recognizing this is most important work with direct application to the safety of the work place.

Minimum Resources

Ten persons per year full-time.

General

Higher productivities and levels of production, combined with more emphasis on machine-mined coal, will tend to increase the rates of emission

of methane and dust. The safety of Canadian mines will be seriously affected if the research work described above is not carried out. Benefits from this research would apply to both national and provincial economies, as well as to industry. The staff presently involved at CANMET are specialists, and the value of their important work is recognized. Other coal producing countries are performing similar work, and a watching brief on this should be maintained. In some fields, methane drainage in the west for example, international experience is, however, of limited value.

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Project 334201 - Coal Preparation Pilot Plant

Objective

A versatile pilot plant should be developed, with emphasis on the scientific aspects of the work, and with particular capability for processing near-gravity coals, and for reducing sulphur. The facility should be available to eastern Canadian coal users and producers.

Relevance

This work is considered very relevant both nationally and provincially.

Time Frame

This work is both of immediate importance, and important in the medium term (0 to 10 years).

Specific Work

Complete acquisition of equipment for the pilot plant.

Update the equipment capabilities as required.

Provide emphasis on instrumentation, monitoring, and control of the coal preparation process.

Relative Value

80.

Minimum Resources

Four person years full-time are a recommended minimum. In addition, adquate funds for acquisition of such capital equipment as a BATAC jig must be allocated.

General

This project is important, and must be retained at current or expanded levels of effort. It is unlikely to be duplicated elsewhere in Canada, although consideration should be given to locating a similar plant in eastern Canada. Considerable effort in coal preparation, especially sulphur removal, is underway outside Canada. These efforts should be followed closely, and developments introduced when appropriate.

Project 334202 - Coal Preparation Process Improvement

Objective

To demonstrate significant improvement in recovering coal from western bituminous middlings, and recovery of coal in western coal fines, in recovery of eastern coal fines, in removing sulphur, and in recovering coal from waste materials.

Relevance

This work could contribute greatly to improved coal production at higher efficiency from both existing and new preparation plants.

Time Frame

Immediate and medium-term (0 to 5 years).

Specific Work

Substantially as now indicated, but with attention given to re-processing mine waste materials. Details include:

commercial washery losses and possible recovery;
flotation and selective flocculation;
oil agglomeration;
recovery of coal from preparation plant waste materials;
high gradient magnetic separation, and dry separation;
characterizing inorganics in coals;
evaluating the potential of chemical comminution (and chemical preparation in general).

Minimum Resources

Ten person years (as at present).

General

The work in this project must be coordinated with the pilot plant operations.

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Project 334203 - Coal Washery Effluent Water Treatment

Objective

To develop and demonstrate procedures for treating coal washery water by flocculation, settling and dewatering, and to evaluate and publish characteristics of commercial flocculants available in Canada and characteristics of process water by region in Canada.

Relevance

Environmental requirements and water scarcity increasingly emphasize the need to upgrade effluent water quality. Without such work the operation of existing preparation plants, and development of new plants, could be handicapped.

Time Frame

Of immediate and medium-term importance (0 to five years).

Specific Work

Substantially as described in the present project, specifically:
completing the automated settling rate instrument;
continuing the characterization of commercially available flocculants;
continuing the assessment of seasonal variation in washery water feed;
additionally, assess the environmental impact of released flocculants.

Relative Importance

80.

Minimum Resources

1.5 person years plus contract funds.

General

Technology developed by CANMET can be transferred directly to industry, with the aid of consultation from time to time with EMR staff. The mobile pilot plant (see project 334205) is not seen as required to transfer technology. Test equipment if needed should be available from, for example, reagent suppliers.

Project 334204 - Characterization of Canadian Coals

Objective

To evaluate and catalogue the preparation characteristics and potential of Canadian coals, using both bench scale and pilot plant scale tests.

Relevance

Knowledge of coal preparation characteristics is most valuable to designers of preparation plants, and is appropriate to the probable expansion in construction of such plants in the next decade.

Time Frame

Progress should be faster than at present, e.g., all typical Canadian coals should be characterized within the next three years, say.

Specific Work

In principle as described in the project:

wash typical thermal and metallurgical coals;

determine bulk surface properties.

Relative Importance

80.

Minimum Resources

1.5 person years (in addition to the staff concerned with pilot plant development).

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Project 334205 - Mobile Pilot Plant

Objective

To complete and demonstrate a mobile water treatment pilot plant to complement CANMET's static pilot plant. (See comments below)

Relevance

Not believed to be particularly relevant.

Time Frame

Medium-term (5 years).

Specific Work

Complete modification of trailer unit.

Complete equipment installation test and commission.

Demonstrate in the field.

Relative Importance

35.

Minimum Resources

One person year.

General

This project is not considered as of high priority, though there may be some value in a separate project to develop a mobile coal treatment plant for dump reclamation in eastern Canada.

Project 338101 - Slurry Transport

Objective

To investigate the feasibility of slurry transport of Canadian coals over various distances.

Relevance

Short range transport is relevant to industry, medium-range (up to 500 km) is of provincial interest, and long-range would be of national importance. All have potential immediate impact; transport is one of the largest cost components of coal supply in Canada, and is frequently a limiting factor in coal use.

Time Frame

Despite the national importance of long-range transport, it is felt that most benefit will accrue from first solving the problems of short and medium-range transport.

Specific Work

Assess the economics of pipeline transport at various sizes of coal.

Determine the effect of coal transport on coal, for example on caking properties.

Determine the feasibility of combining movement by pipe with upgrading functions such as separation of ash and sulphur.

Determine if gasification and/or liquefaction could take place during pipeline transport.

Evaluate transport fluids other than water.

Minimum Resources

Four person years and appropriate contract funds.

New Project - Ash and Moisture Reduction in Low Rank Western Coal

Objective

To develop by 1985 economical and efficient procedures for reducing ash and moisture in western low-rank coals, thus improving transportation economics for such coal.

Relevance

Full advantage of Canada's enormous energy reserves in low-rank coal can only be realized if transportation problems are overcome.

Time Frame

Immediate and medium-term (0 to 5 years).

Specific Work

Evaluate conventional washing of low-rank coal.

Evaluate air tables and cascade driers.

Investigate alternative heat sources for drying.

Investigate de-watering by steam and oil bath drying.

Relative Value

80.

Minimum Resources

Two person years and substantial contract funds (much of this work is suitable for contracting out; an appropriate level of effort might be $200,000 per year for contracts.)

General

The biggest single problem with western low-rank coal is transportation, whether by slurry pipeline or rail. Slurry pipeline is a long-term answer. What must be dealt with as soon as possible is transportation by rail. Reduction in rail freight costs can be accomplished by a reduction in moisture and ash in the coal. A reduction in moisture and ash also has the benefit of improving the calorific value of the coal and thus increasing its potential use in existing plants (largely power plants). A reduction of moisture is best accomplished by the use of hot air. A reduction of ash can

be accomplished by wet or dry methods. To date, very little work has been done on washing (wet or dry) Canadian lignite or sub-bituminous coal. Economics have so far not warranted this. However, there are many undeveloped low-ranked coal deposits that are either high in moisture or ash or both. If a beneficiated product can be produced from these coals then this product might be economically transported long distances to replace more expensive coals at existing plants. Such coal could be introduced now or within the next five years if the price were right.

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New Project - In Situ Gasification of Off-Shore Nova Scotia Coal

Objective

To assess the technical feasibility and probable cost of producing coal gas, suitable for domestic and industrial use, from submarine coal seams above and below those now worked, or likely to be worked, by Devco.

Relevance

Coal seams off Cape Breton are very extensive, and represent an important part of Maritime energy resources. Coal mining off-shore will expand in the near future, and will continue indefinitely. However, a substantial part of the total resource is unlikely to be mined, because such factors as thickness and continuity, and absence of access routes, make the cost prohibitive. In situ gasification of these unmineable seams would be attractive for three reasons: there would be a ready market for the product in the Maritimes (as opposed to elsewhere in Canada, where natural gas is available); an otherwise non-usable resource would be exploited; and it may be possible to work from existing under-sea mining operations, giving relatively cheap, simple access to the seams.

Time Frame

Complete assessments including a demonstration trial in five years (by 1985), leading to development and commercial production by 1990.

Specific Work

Geological assessment and selection of likely seams (using Devco records).

Assessment of possible techniques and access required.

Assessment of precautions necessary to maintain safety and viability of current workings.

Drilling and sampling, samples to be used for bench scale assessment of gasification potential.

Assessment of economics, including markets.

In situ trial with gas production (gas to be used by Devco if necessary).

Relative Importance

60, reflecting potential value to the Maritimes, but also recognizing the relatively small scope for gasification in the nation at large at this time.

Minimum Resources

Contract funds commencing in the first year at $80,000 (equivalent to two man years), and roughly doubling each year for five years.

General

Alberta Research Council wishes to pursue in situ gasification, but encounters a relatively unfavourable climate at present in western Canada, because of excess natural gas supplies. Work on a contract basis to ARC in Nova Scotia would be timely and appropriate; this would be an excellent opportunity for Canadian expertise to be applied to an important project.

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New Project - Dust Control in Coal Mines

Objective

To identify the nature and severity of the dust problem in both underground and surface coal mines, to evaluate the application of the latest dust control techniques in Canadian mines, and to develop techniques for controlling dust in conditions peculiar to Canadian mines.

Relevance

Current statutory limits for airborne dust will probably be lowered in the near future. Before this is done, methods of achieving the proposed standards must be available. Mechanization is likely to increase and, together with higher production levels and more concentrated production, will increase the need for more effective dust control.

Time Frame

This effort should commence immediately. The rate of progress will depend to some extent on the timetable observed by provincial authorities in lowering the statutory limits for airborne dust.

Specific Work

The most critical areas for the reduction of airborne dust are:

a) in development drivages and room and pillar operations using continuous miners;
b) on longwall faces using shearers;
c) in coal handling plants;
d) in surface mining operations.

The special problems of dust created by mining friable coals in the mountain coal fields of western Canada and of shearing the harder coal in the Maritimes should be recognized.

The work should include:

a) methods of reducing the production of ultra-fine dust;
b) methods of suppressing or filtering out the dust formed;
c) ventilation systems to reduce dust levels;
d) use of personal protection devices (masks, ventilated helmets, filters, etc.).

There is a great deal of international expertise which is applicable to Canadian mines and which should be utilized. CANMET has specialists in dust control based at Elliot Lake, and any effort in coal dust reduction should consider using this expertise.

Relative Value

100.

Minimum Resources

Two man years annually; outside consultants could assist in documentation of international expertise and industry should be expected to participate. Cooperation with the Coal Mining Research Centre is essential to avoid duplication.

New Project - Mining Technology

Objective

To develop mining techniques for those substantial reserves of coal where geological conditions inhibit the adoption of conventional techniques.

Relevance

There are very large reserves of high quality coal, particularly in the mountains and foothills of western Canada, which cannot be mined by conventional techniques. The associated geological conditions include:

a) very thick seams (more than five metres) at steep gradients (greater than 20°);
b) medium to thick seams (two to five metres thick) at steep gradients (greater than 20°);
c) extremely friable coal;
d) seams subject to extremely variable thicknesses and gradients.

In some cases where the reserves are close to existing infrastructure the mining conditions may be the principal parameter inhibiting development.

Time Frame

This work should commence immediately.

Specific Work

Two examples are given.

a) Application of highly mechanized longwall systems in medium to thick seams at gradients greater than 20°. This technique has been practised with varying degrees of success in different parts of the world. As a first stage, this information should be collected and evaluated for application in Canadian mines. In the second stage a site-specific project could be initiated by inviting participation by industry in a feasibility study.
b) Application of hydraulic mining techniques. Hydraulic mining has also been practised in many countries under a variety of conditions. Publically available information should be collected and documented. The application of various hydraulic techniques to geologic models typical of

substantial reserves should be examined at this stage. This study should then be made available to industry. Further participation on a cost-sharing basis by CANMET would be worthwhile if a number of properties with similar problems were identified.

Relative Value

70.

Minimum Resources

One person year annually. The bulk of this work should be contracted out to industry, a recommended level of effort would be $250,000 over two years.

New project - Geophysical Logging for Coal Quality

Objectives

To develop and demonstrate geophysical logging techniques that will allow a good estimate of coal quality parameters in place, particularly sulphur content.

Relevance

Most boreholes drilled for coal exploration and reserve development are logged geophysically. Coal samples are usually recovered, and used for proximate and ultimate analysis, etc. However, often there are difficulties in recovering an adequate, representative sample, and such analyses as sulphur content determination may be difficult or impossible. Techniques to improve the assessment of quality parameters using existing or new geophysical measurements would greatly improve the usefulness of results from drilling.

Time Frame

To begin now, and to run for three years.

Specific Work

1. Assess current logging techniques.
2. Develop new or existing techniques to predict coal quality.
3. Use existing logs and samples to assess value of current logging.
4. Liaise with coal exploration programmes to try new techniques.

Relative Value

50.

Minimum Resources

Contract funds would appear appropriate: excluding drilling (which should be available as a cost-contribution from industry) costs would be about $250,000 over three years.

APPENDIX A

SUB-COMMITTEE MEMBERS

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APPENDIX B

Sub-Committee Procedure

The supply sub-committee met for two days, Oct. 3 and 4, 1979, in the Calgary Inn, Calgary, Alberta. A reception on the evening of Oct. 2 preceded the meeting. On the first day, current projects in the supply part of CANMET's energy program were reviewed, with considerable discussion both on detailed aspects of the projects, and on energy policy and related matters in general. There were no formal presentations by CANMET staff, because briefing notes on each project had been sent to members one month before the meeting. However, representatives of most relevant work in CANMET were present to answer questions and respond to members comments. A short slide presentation on CANMET's laboratory facilities at Clover Bar, Edmonton (the Western Research Laboratory) was given immediate after lunch on Oct. 3.

From 9 a.m. to 11 a.m. on Oct. 4, the committee discussed potential projects CANMET could engage in, i.e., projects the committee felt are desirable but that are not in the current program. General recommendations, e.g., concerning level of funding, were also discussed. From 11 a.m. until the end of the meeting the sub-committee divided into working groups of two or three members, and prepared draft statements on each actual and proposed project. To obtain uniformity, the following format was used.

Objective: what should the project achieve?
Relevance: is it in the national/provincial/industrial interest?
Time frame for achieving objective
Detailed work required
Relative importance: 0-100*
Resources required
General comments

---

*An arbitrary scale was adopted, with 100 indicating a project is absolutely vital to the national interest and must start now, 10 indicating an unimportant project.

The discussion on Oct. 3 and until 11 a.m. on Oct. 4 was tape recorded; no transcription was made but the tapes were used to help prepare the discussion summary of Appendix C.

A dinner for sub-committee members and CANMET attendees was held on the evening of Oct. 3.

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APPENDIX C
SUMMARY OF DISCUSSIONS

Coal quality analysis and reseve analysis were discussed together. The differing definitions of reserves used by producers are recognized as a source of confusion, and efforts to standardize are necessary. B.C.'s approach to coal resources/reserves is to ask: "What type of coal is in the ground?". There are six broad types, and a large percentage of B.C. coal is clearly very similar to a large proportion of Australian coal, with which it competes for export markets. This broad information can influence coal policy and development. Reserves are dynamic; as a market develops, so may "reserves".

Determining coal quality is felt to be essential. The particular work at Point Edward, Nova Scotia (a small analysis lab, partly funded by Nova Scotia) is considered very valuable by the province, and Nova Scotia wishes such a facility to be maintained in the province. The data provided are widely used. However, a facility may be maintained by other than CANMET in principle.

Objectives under quality of coal are perhaps not being met. Is there any data being usefully assembled and disseminated? If not, there should be. CANMET should not just be running a lab, but must ensure that the work done helps meet the objectives.

Current tests which are in international use to determine coal coking properties do not properly reflect the coking propensities of Canadian coals. There could usefully be tests developed specifically suited to Canadian coals that do properly forecast coke properties. This is a marketing problem; western metallurgical coals are undervalued because international standards are not applicable to our coals. A program to rectify this must be long term, and involve government. It would be valuable to assess Canadian and world metallurgical coal needs on a fixed standard. CANMET has much data, and could help coal producers determine where their coal fits in world markets. As long as internationally accepted coking coal tests do not fairly assess Canada's metallurgical coal the country's coal producers will continue to be at a disadvantage in marketing their product.

CANMET should have an objective of developing a system for analyzing Canadian coals. Cost recovery work is valid provided the data collected are both useful and used. Cost recovery as a lab service should be discouraged. Quality of thermal coal must be considered, as must transportation, which is the most critical problem facing thermal coal development. Moisture content is especially a problem, particularly in the light of high freight rates which are crippling the export potential of thermal coal. Solving these problems could lead to exports.

There may be scope to upgrade thermal coal by skimming off a high value product, say 12000 BTU/lb, that could be transported, and leaving a low heat value residue to be burnt at mine mouth. If this were viable, research on how best to use the residue would be needed.

All such work must be done in the context that energy reserves of plains coals alone are comparable to the total reserves in oil sands; coal is a vast reserve meriting serious exploitation.

There is some doubt as to the usefulness of reserve and resource assessment bearing in mind the dynamic nature of reserves, and that there must be a market before reserves are meaningful, i.e. as market needs arise, coal can "suddenly be mineable". On the other hand, there should be a federal base of information on types of coals, their uses, and whether or not they are available with current technology. The difficulty inherent in federal-provincial jurisdictions is recognized. Federal government should take the lead in establishing how Canadian coal should be defined. A national inventory is desirable, but it could be based on provinces' own assessments.

It seems clear there will be a large increase in demand for coal, and reserves should be defined as well as resources, and CANMET should be involved in actually collating reserve data. However, there must be more discussion now between provinces, federal government and industry to achieve an agreed policy.

Typical information coal companies would like to have is the amount of competitive coal available, and a national inventory would help. At some time, too, Canada may have to look at coal exports and be sure there is enough to satisfy domestic needs.

Some aspects of the reserve project are not relevant to the work described - equipment studies for example. This may be valid, but must be

considered in its own right. CMRC is doing similar work (e.g. bucket wheel studies), and might be interested in the Bonner and Moore model.

Governments should be able to ensure mining practice meets national objectives, for example, meeting a minimum recovery percentage which takes into account mining conditions.

It is uncertain who does or would use coal reserve data, although several companies apparently do use the EPS coal reserve publication, despite its limitations.

It may well be that CANMET should not be involved in oil sands research because of the massive effort by AOSTRA, but the federal government should be aware of what is going on. Half-a-man year is not sufficient, given the accelerating pace of oil sands research. There are areas where CANMET could contribute to oil sands R & D, e.g., in gas emission and analysis where they already have relevant expertise and equipment.

A basic question is: "Does the federal government wish to play a role in oil sands development?". If yes, an appropriate area would be in technology development. AOSTRA's mandate is to develop new technology. This leaves a vast field, that of optimizing current technology and ensuring that efficient methods are identified, and that operators have access to the information. This is especially relevant to oil companies which - perhaps based on U.S. anti-trust experience - tend not to consult each other. Specific examples include Syncrude's use of draglines, which in hindsight appears to have been a major error. If proper information were available, this second oil sands mining operation should have been an improvement over the first, that of GCOS, and not have turned out to be retrograde.

Tailings disposal is another major problem in oil sands mining, one that ought not to be as severe in view of the immense experience in the conventional mining industry with tailings ponds. The federal government should firmly adopt the role of looking at all available technology, and coordinating the efforts of the many parties involved.

The coal mining ground control objective excludes R & D on Maritime coal. Effort is needed on undersea mining in Nova Scotia. Specific problems include the current large barrier pillars, representing 30-40% of coal left behind, and the effect on multi-seams of mining out one seam. A minimum level of effort would be 3 PY's for 2 years, on site in Cape Breton.

It may be inappropriate for CANMET to be in the field of equipment development, e.g. the rapid development work at Kaiser. On the other hand, an advantage of federal government involvement is that the results of R & D become publically available. An example is the work at McIntyre on diesel engine development. It appeared subsequently that Kaiser had simultaneously done similar work. Government involvement might at least have avoided this duplication. Similarly, CANMET at least could be a focus for knowing "what is going on".

Surface mining R & D was suggested as a role for CANMET, although it was pointed out that CMRC is involving itself in surface mining, particularly equipment, and CANMET and CMRC do coordinate their work. Dust suppression was cited as an example of a difficult problem in surface mining - and even more so in underground mines.

Environmental standards for respirable dust can only become more stringent. A major effort is needed in this field to ensure that research observations from other countries are fully implemented in Canada.

In Nova Scotia, there is as yet no clear need for surface R & D. However, in the past CANMET has been asked specific questions, e.g. on slope stability, and has seemed reluctant to be involved. Availability of CANMET staff for such consulting is urged, particularly when sought by provincial agencies. CANMET's position is that usurping traditional consulting roles is avoided. When Devco has wanted assistance from CANMET, this has been forthcoming.

One difficulty the sub-committee encounters is how to make recommendations when it is not clear - or perhaps even known - what work is going on elsewhere. Duplication is generally not desirable - although it has been suggested that duplication in fact can lead to better results.

Written comments from Kaiser were that the ground control work at KRL is proceeding well, and is appreciated. However, there is no obvious need for CANMET to produce "design guidelines" for hydraulic mining - this information is available directly from Kaiser. Other sub-committee members felt that information dissemination generally is an essential CANMET role, and that it would be appropriate to issue guidelines, or other material, to convey current knowledge in hydraulic mining.

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Some specific aspects of underground coal mining were raised. Methane explosions clearly can be triggered by sparks from a shearer pick striking a stone intrusion. It is difficult to avoid this - even a small stone is sufficient. If an alternative pick material, that would not cause an incendiary spark, could be found - admittedly a difficult task - this would be a breakthrough. There has been U.K. work on spark suppression at a pick by water spray, although this would not seem to be a guaranteed route to success. Pick material of course must be hard - perhaps metallurgists could look at the problem. Another approach might be developing guide mechanisms for horizontal control of longwall cutters so that they will not hit over or under-lying strata. Appropriate sensors would be needed. This has been looked at to avoid dilution - perhaps it has safety relevance too. Pick speed is a factor - if it could be reduced without affecting cutting effectiveness, this would be a help.

Methane drainage was discussed - does CANMET do enough to disseminate knowledge e.g. from methane contracts. There is a need for more positive feedback to CANMET from operators on research work carried out. Much more work is needed on methane drainage - Devco want to get more gas out of their coal, ahead of mining. In-seam drainage needs to be developed - work here is also needed in mountain coals. CANMET has proposed methane drainage recently, at Canmore Mines, but mine closure has stopped this work. It should be possible for CANMET to propose similar work at the McIntyre No. 5 mine or at the Kaiser operations in Sparwood - this would be welcomed.

Nova Scotia for some years has been concerned that a fire resistant fluid test facility be set up. CANMET is working on this, but there has been a suggestion recently that progress is hampered by a relatively small lack of funds - $30,000. This is regrettable.

Underground mechanised mining of sub-bituminous coal, using longwall shearers or continuous miners, with the likelihood of wet fines, may greatly increase the problems of spontaneous combustion in stockpiled coal. Current surface mining, with larger coal sizes and drier conditions, as yet is not so troubled. The spontaneous combustion problem in fact could be a major factor in inhibiting the movement of sub-bituminous coal over any distance, particularly for underground coal. Basic R & D into this is needed. Devco similarly believe spontaneous combustion will affect the Prince Mine coal.

In sensing spontaneous combustion by CO monitoring, the tube bundle approach may be less satisfactory than, e.g. analysis at the point of sampling. As yet, however, satisfactory sensors for this are not available. The CO monitoring installation at Sparwood is working well. Further work should concentrate on expansion of the system to give more information and earlier warning of heatings.

CANMET would be interested in, and Devco would agree to, involvement in the commercial exploitation of methane drained from the coal seams off Nova Scotia. Devco are now in a consortium with PetroCanada and Algas for this purpose.

Work at the coal preparation pilot plant at Edmonton was introduced by a CANMET slide presentation. It was emphasized that the CANMET plant is quite different from that of Birtley Engineering. CANMET's plant is dedicated to R & D, and is also continuous, whereas coal from various stages of the Birtley process must be dumped, and then reloaded into the next stage. Nova Scotia has had good cooperation from CANMET, in particular in setting up a coal preparation plant in the past to recover coal from waste dumps.

The pilot plant work is felt to be very valuable and much needed, and CANMET is encouraged to proceed with plant expansion. A Batac jig is specifically felt to be an important piece of equipment, and should be added.

Allocation of work in the pilot plant was discussed. By and large, work is performed after discussion with industry, and with an element of cost-sharing. Work must relate to CANMET's R & D objectives; the more closely related it is, the larger is the share of costs, e.g., for washing a given coal, that CANMET will contribute.

To date, CANMET has emphasized preparation studies on Western Canadian metallurgical coals, with some notable exceptions such as the study of Hat Creek coal. In future, there might be a need for more work on thermal coal. CMRC is particularly interested in thermal coal preparation, and emphasizes the need for cooperation between CANMET and CMRC.

CANMET's work in chemical coal preparation was briefly described. A small contract in chemical comminution has just been let, mainly with the intention of allowing CANMET to get first hand knowledge of developments in the field. Devco was approached independently by the contractor to fund this same work, but as yet has provided no money; they are however, interested.

Ontario Hydro has looked closely at the economics of burning western Canadian thermal coal. Of 37 plants none is designed to burn western coal. All stations use a blend of coal, and in principle up to 40% of a blend could be low volatile western coal. However, burning low volatile high ash coal is a problem. This is not necessarily a national R & D problem, but if western coal were treated to be low moisture, low ash, it would be much more useful. (Against this, at present Ontario Hydro foresees no increase in western coal use to 1985 beyond the present bituminous imports from Luscar and Byron Creek).

When considering metallurgical coal as opposed to thermal coal, there is some indication that some metallurgical coal grades in future will be very attractive as an export thermal coal. Thus Canada could be selling high and medium volatile bituminous coals as thermal, and sub-bituminous coals may in fact be very far from being exported. Thus current metallurgical coal preparation studies could well be directly relevant to thermal coal in future.

Export of sub-bituminous coal is handicapped by the high cost of moving a relatively low BTU value product. To overcome this could be a long job. Even if technological breakthroughs in upgrading or in transporting were to emerge in, say, five years, it would be a further 5-7 years before the necessary approvals, etc., were completed, and movement could begin. It would be longer before suitable power stations could be built or modified.

Oxidized coal R & D is needed. There are large amounts of such coal, and its treatment and recovery at present pose problems. CANMET is encouraged to carry out appropriate R & D.

Despite the time lag before sub-bituminous thermal coal could be used extensively at points distant from the mine, R & D is needed now. In fact, the long-time lag likely emphasized the need for immediate research in this area. General opinion is that thermal coal R & D is needed now, and CANMET should do it. The $130,000 needed to buy and install a Batac jig, for example, is considered a large expense by CANMET. In fact such a cost is small compared to the potential benefits, and such funds should be made available.

Automation of preparation plants to optimize both product and efficiency of operation is a fruitful R & D area. A major problem is the lack of

reliable sensors to measure accurately the properties of the plant stream. CANMET is working in this area now, and wishes to do more. This - and other topics - could be fruitful areas for cooperative industry-government research.

For cooperative research to be most effective - and for maximum effectiveness in general, travel funds for researchers should be available. It is essential for, e.g. CANMET workers, to get out often and talk to their counterparts, or those connected with R & D, in industry and provinces.

The scope for contracting out CANMET's preparation R & D was questioned. In fact, CANMET does use contracts effectively in this area, including paying Birtley to wash some coals for later research in carbonization. It was suggested that contracting-out decisions should be made on the basis of optimizing the value for money. If CANMET can get better value by doing work in-house, this makes economic sense. In fact, CANMET is constrained by such non-technical factors as the make-or-buy policy. Within these constraints, CANMET ensures contracts do enhance the total R & D effort.

Preparation of coal may have a role to play in sulphur removal for environmental reasons, at least for high sulphur eastern coals. It is possible that new U.S. standards, which will require all coals to have sulphur removed to some extent, may influence Canadian practice, and this would affect the role of preparation. There may be a case for starting appropriate R & D now, to be prepared for such an eventuality. On the other hand, if methods to remove sulphur were developed, this could precipitate a demand to use such methods, i.e. "best available technology". It is clear that sulphur emissions are now, and will increasingly be, a major concern, and may preclude the use of some coals entirely.

CANMET's process water treatment work was considered to be valuable. Alberta is now concerned that flocculants released to the environment could be harmful, and studies to characterize flocculants are useful. There could be applications of flocculants in cleaning-up water in closed circuit hydraulic mining. Research should include studies of the best way to apply flocculants, e.g. in solid or in liquid form. One problem with flocculated material disposed of as tailings is that the final settled mass is gelatinous, and never fully consolidates; it remains effectively unstable. Thus, although flocculants may speed settling, and reduce the initial size of tailings pond required, the end results may be a very unsatisfactory mass in the

pond. The large areas of ground currently taken up by tailings ponds, e.g. in the Crows Nest Pass area, are a potential cause for concern, so research into speeding up settling without producing an undesirable mass is relevant.

As yet, there appears to be no case where use of flocculants has been expressly forbidden on environmental grounds, but McIntyre has been advised against using some flocculants in the past.

CANMET's intention in preparation to concentrate on characterizing "difficult" coals does not meet with full accord. It would be better to look at representative coals; for one reason, "difficult" is not a meaningful term. A coal may be "easy" to wash to a certain level, and "difficult" to wash to a higher level, which may be needed if the coal is to be a marketable product. A catalogue of coal preparation properties is desirable; it would for example be of use to a company designing a preparation plant. Even currently, long-range plans for preparation plants are being based on inadequate knowledge of general behaviour of coals when being washed, and as a result, plants are over-designed to be safe. Actual operating plants often have problems that could have been alleviated by proper knowledge of coal behaviour. Excessive fines production is an instance.

CANMET's target, of characterizing about 25 coals by 1985, appears to be beyond current rate of tests. One reason is that, when the coal market is depressed, it is more difficult to get samples to wash. As the market improves, so will this situation. Another problem is lack of manpower in the current restraint program. It was felt that companies whose coal is being washed should be able to provide manpower to help run the plant. This may not be possible in current policy, but should be looked into.

Over the next year or so, as the market picks up, pressure from producers to give attention to coal attrition characteristics, and so forth, will increase.

Several companies have expressed interest in having the mobile water treatment pilot plant visit their sites. There is potential for such a unit; Fording Coal, for example, could have used one recently. Nova Scotia is looking at tip recovery, and recovery from tailings ponds, and this could be a useful area for a mobile unit. On balance, the completion of the unit must be encouraged; once ready, many uses will be found.

Coal slurry transporation work is encouraged, primarily because anything that helps overcome the problem of coal transportation in Canada will be very valuable. Short-range pipelines - up to 100 miles - will quite likely be built in Canada, and appropriate studies are needed. Long range pipelines need very large volumes of coal to be economic. CANMET, in conjunction with Transport Canada, is now looking at possible coal-slurry movement to heavy oil deposits for steam raising. Two million tons a year or so may be viable for taking new metallurgical coal to an existing rail head. Similarly, short range pipes to take coal to an existing wash plant may be important. Hydraulic transport underground, with say 2-inch top size, could also be a fruitful area for R & D. In fact coarse coal movement should be the thrust of CANMET's studies. Spin-off from such studies could include hydraulic reclamation work, and hydraulic disposal of wastes back into a mine. In Australia, current effort includes attempts to beneficiate coal as it is piped, e.g. by oil agglomeration.

Amongst areas in which CANMET is not currently involved, in situ gasification is important. It is felt that R & D is slipping in Alberta, and that perhaps provincial interests do not match national interests. In Nova Scotia, there may be good potential for gasifying some of the undersea seams. Some of these cannot be recovered by mining, and therefore the resource would otherwise be lost. Access should be possible from the existing workings. There would be a ready demand for the gas. It may also be that in situ gasification would make sulphur removal easier.

Another area for work is moisture and ash reduction in sub-bituminous coals and lignites. This is critical for wider use of these very large energy resources.

Mining technology and mine planning in general are currently neglected. In Canada, more is known about foreign mining techniques than about those used here. Specific topics might be longwall mining at gradients above 15° - though Devco have some experience at gradients up to 38°. Coal seams over these gradients, 1.5 to 3 metres thick, represent a large reserve, particularly in Western Canada, which could be mined by longwall if appropriate techniques existed. One drawback is the uncertain economics of various mining techniques. McIntyre is looking seriously at restarting longwall mining within five years, but opinions on the best approach vary radically. This indicates R & D is needed, particularly when upwards of $10 million must be

paid out just to set up one longwall panel to verify the applicability of the method. This is one case where a great deal of information is available internationally. This should be documented.

One approach might be to establish the mining techniques available, and begin ranking them in the context of Canadian mining conditions. Open pit mining technology should not be neglected.

Geophysical logging for coal quality is an area where developments would be useful. Techniques to analyze for ash and sulphur, for example, directly in the borehole, are invaluable in establishing the suitability of a given coal in the ground, and hence in planning mine developments. This technique is in use at present but it is doubtful if the potential is being realized as equipment and techniques are new.

Several non-research issues affect CANMET's R & D performance. Contracting-out is currently an extremely cumbersome process. It is lengthy and tedious, and often ties up senior company staff in detailed negotiations over matters that do not merit such attention. At times, it can positively discourage companies from entering into contract research - especially large companies such as coal producers, for whom the funds involved are irrelevant. This should be reviewed, and improved procedures adopted.

Much of the work seems to be done without an adequate hierarchical policy structure. Quite apart from national policy, which for coal in particular is sadly lacking, there does not appear to be a framework of interlocking objectives which can guide the work being done. CANMET, and EMR in general, are actively reviewing this situation now, and improved objectives are being formulated.

Most important, the funds allocated to R & D in general, and to coal R & D in particular, are utterly inadequate. For coal, they are probably low by an order of magnitude or more. If Canada is serious about developing energy self-sufficiency, it must recognize the important role coal can, and eventually will, play. Lack of policy and lack of adequate research funding are the twin factors most inhibiting progress towards exploiting even modestly coal's potential. The funds available - in CANMET's case, for coal supply, about $3 million a year total - are pitifully small. If nothing else, they are a fraction of the revenue returned directly to the federal government in corporate income tax from coal producers and users. This is a case where

virtually any increase in funds for R & D would bring about substantial increase in coal use (for example, in exports) and would thereby return multiples of the outlay in extra tax revenue. The strongest possible plea for substantially increased R & D funding must be made - and must be made federally, if the nation at large is to benefit.

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APPENDIX D

Suggested Terms of Reference for an Oil-Sands Mining NACMMR Sub-Committee

Background

A cornerstone of the drive to achieve energy self-sufficiency by 1980 is substantial accelerated development of Alberta's oil sands. The NACMMR supply sub-committee currently can devote little time to what is at present a small aspect of CANMET's energy supply programme; more effort is apparently devoted to oil sands upgrading in the processing sub-committee, but it appears clear that the NACMMR review process for oil sands is fragmented, and does not properly recognize the importance of this resource.

It appears that substantially increased R & D is needed for oil sands in general, and oil sand mining in particular. The proposed NACMMR sub-committee, which would review all CANMET R & D in oil sands, would be able to make properly balanced recommendations, and could foster proper coordination of national efforts.

The sub committee should:

1. undertake a review of long term technological and procedural requirements with respect to developing heavy oil and tar sand resources, with early emphasis being placed on the current technological and environmental problem areas;
2. recommend and/or develop procedures by which full coordination with other working groups can be achieved so that conflicts and duplication of effort can be avoided;
3. review present status of R & D and develop a program of immediate activity, suggested areas to include:
   - surface mining and overburden removal
   - underground mining
   - in situ production
   - ore treatment (extraction)
   - water management
   - tailings disposal and sludge ponds
   - upgrading
   - environmental factors